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CLINICAL MANUALS

FOR

PRACTITIONERS AND STUDENTS

OF MEDICINE.

SURGICAL

DISEASES OF THE KIDNEY.

BY

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WITH 40 ENGRAVINGS AND 6 CHROMO-LITHOGRAPHS.

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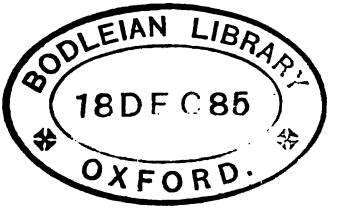
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PREFACE.

THIS work contains a brief description of the normal regional anatomy, and a pretty full account of the malformations and other abnormal anatomical conditions of the kidney, subjects of much importance to the surgeon who is about to perform any operation on the organ; also systematic accounts of the injuries and diseases of the kidney; and of the methods of performing the several renal operations, namely, nephrectomy, nephro-lithotomy, nephrotomy, aspiratory puncture, and nephrorraphy. Under the diseases are included somewhat detailed descriptions of those affections of the kidney which are secondary to obstruction in, or operations upon, the lower urinary organs, such as suppurative nephritis, the various forms of urinary fever, hydro-nephrosis, and pyo-nephrosis.

I desire to acknowledge my indebtedness to Drs. Goodhart, Norman Moore, and Chaffey, for assisting

me in obtaining valuable materials from the post-mortem records of Guy's, St. Bartholomew's, and the Ormond Street Hospitals respectively; and to my friends and former pupils, Messrs. Thornton and Winter, for aid in searching the Middlesex Hospital records, and several literary works.

To Mr. J. Bland Sutton also my best thanks are due for his careful perusal of the proof sheets, and for several valuable suggestions whilst the book was passing through the press.

CONTENTS.

CHAPTER		PAGE
I.	Regional Anatomy of the Kidney	1
II.	Misplacements of the Kidney	16
III.	Movable Kidney	24
IV.	Floating Kidney	45
V.	Malformations of the Kidney	51
VI.	Absence of one Kidney—Single Kidney	68
VII.	"Unsymmetrical" Kidney	70
VIII.	Atrophy of one Kidney	76
IX.	Fusion of two Kidneys into one—"Solitary" Kidney	82
X.	Symptoms and Diagnosis of Single Kidney	100
XI.	Absence of both Kidneys	112
XII.	Injuries of the Kidney — Subparietal Injuries	116
XIII.	Injuries of the Kidney communicating with an Open Wound	153
XIV.	Injuries of the Kidney: Prolapse of the Kidney (injured or uninjured) through an External Wound	181
XV.	Perinephric Extravasations, Traumatic and Non-Traumatic	185
XVI.	Perinephritis and Perinephric Abscess	205

CHAPTER		PAGE
XVII.	TRAUMATIC NEPHRITIS	247
XVIII.	URINARY FISTULÆ	254
XIX.	ABSCESS OF THE KIDNEY	272
XX.	GENERAL REMARKS ON RENAL AFFECTIONS SECONDARY TO DISEASES OF, OR OPERATIONS UPON, THE LOWER URINARY ORGANS	282
XXI.	HYDRO-NEPHROSIS	290
XXII.	CONGENITAL HYDRO-NEPHROSIS	325
XXIII.	PYO-NEPHROSIS	336
XXIV.	ACUTE AND SUBACUTE INTERSTITIAL NEPHRITIS	356
XXV.	SUPPURATIVE NEPHRITIS, PYELITIS, AND PYELO-NEPHRITIS	366
XXVI.	URINARY FEVER—URETHRAL FEVER—URÆMIC FEVER—CATHETER FEVER	398
XXVII.	HÆMORRHAGE FROM THE KIDNEY A RESULT OF CATHETERISM	435
XXVIII.	RENAL DISEASE A CAUSE OF IRRITABILITY OF THE BLADDER—DISEASES OF THE KIDNEY WHICH SIMULATE DISEASE OF THE BLADDER—RENAL DISEASE A PROBABLE CAUSE OF PROSTATIC ENLARGEMENT	441
XXIX.	RENAL CALCULUS	451
XXX.	TUBERCULOUS AND SCROFULOUS KIDNEY	473
XXXI.	TUMOURS OF THE KIDNEY	483
XXXII.	SOLID TUMOURS OF THE KIDNEY	495
XXXIII.	CYSTS OF THE KIDNEY	500
XXXIV.	METHODS OF PERFORMING THE OPERATIONS ON THE KIDNEY	521
	INDEX	539

SURGICAL
DISEASES OF THE KIDNEY.

CHAPTER I.

REGIONAL ANATOMY OF THE KIDNEY.

For the purposes of this manual it will be desirable to commence with a description of the regional anatomy of the kidney, so as to enable the reader to readily refresh his memory respecting the structures which must be cut through or disturbed in the event of any operation upon the organ; or which are likely to be involved in inflammation or suppuration, or by new growths of the kidney. But first a word or two as to the size and shape of the kidney.

The kidney measures about 4 inches in length, 2½ inches in its transverse axis, and 1¼ to 1½ inches in thickness. The left kidney is usually a little longer and a little narrower than the right. The weight of each is from four to four-and-a-half ounces. **In form** the kidney is compressed from before backwards so that it presents an anterior and a posterior surface; a long, convex outer border, and a shorter concave inner border with a deep notch, the hilum, at its mid-point; and an upper and lower extremity, each of which is somewhat wider than the transverse measurement of the central part of the organ, the upper extremity being usually somewhat wider than the lower.

The anterior surface is convex and looks

somewhat outwards away from the sides of the bodies of the vertebræ, as well as forwards. **The posterior surface** is flattened and is directed somewhat inwards towards the tips of the spines of the vertebræ, as well as backwards. The thick rounded upper end of the kidney is nearer the spinal column than the lower, and has a slightly more posterior position: the suprarenal capsule descends a little upon its anterior aspect.

Owing to the oblique direction of the surfaces and extremities of the kidney the outer convex border is inclined somewhat upwards and backwards towards the parietes of the loin, whilst the inner border looks somewhat downwards and forwards. The inner border at its upper part is 1 inch from the middle line of the body; the outer border at its lower part is 3 ¾ inches from the middle line of the body.

The position of the kidneys is deep in the loins along the sides of the last dorsal and first three lumbar vertebræ. The kidney rests about equally upon the diaphragm and the anterior layer of the posterior aponeurosis of the transversalis muscle which separates it from the quadratus lumborum muscle; to a slight extent it rests also upon the psoas muscle. The upper edge of the kidney corresponds with the space between the eleventh and twelfth ribs, and the lower edge is nearly on a level with the middle of the third lumbar spine. The left kidney, owing to its more elongated shape, sometimes reaches lower than the right.

The kidneys are enveloped in areolar tissue, which contains an abundance of fatty tissue in its meshes. The tissue is called the tunica adiposa. It is thicker and more abundant posteriorly than in front, but everywhere it completely surrounds the proper fibrous capsule of the gland; and sometimes after inflammatory changes have taken place in it the adhesion between them is very intimate and even inseparable.

It is perhaps to this "packing" of areolar fatty tissue, more than to any other single feature of its anatomy, that the kidney owes its fixity of position in the recess of the loin. But in spite of this, and of the restraint afforded by the peritoneum which covers its anterior surface, the kidney has an undoubted tendency to shift from its bed, and in time to become displaced by accident, or by the mere forward drag of its weight against the peritoneum. Hence in cases in which the connections of the peritoneum are abnormal, or the areolar fatty tissue of the loins is deficient, the kidney may be found misplaced and mobile, as will be described in the next chapter.

The amount of fat in the tunica adiposa is variable. In fat persons it is often very considerable, and may mislead one at the bed-side examination as to the size of the kidney itself. Again, when fat persons lose flesh rapidly the fatty elements of the tunica adiposa are quickly absorbed, the capsule becomes loose, and its connections both with the kidney and the surrounding parts are relaxed, so that the kidney acquires a degree of mobility which in some cases is very considerable.

The front of the right kidney at its upper end touches the under surface of the liver, then the peritoneum passes over part of this surface, and the duodenum and commencement of the transverse colon are in contact with it where they are uncovered by peritoneum.

The front of the left kidney touches the fundus of the stomach, and then comes in contact with the pancreas, and lower down still with the commencement of the descending colon; whilst the external border of this kidney is in contact in the upper two-thirds of its extent with the spleen.

The kidney occupies a space which is represented on **the anterior surface** of the body by the following

diagram (Fig. 1). A horizontal line through the umbilicus is below the lower edge of each kidney; a vertical

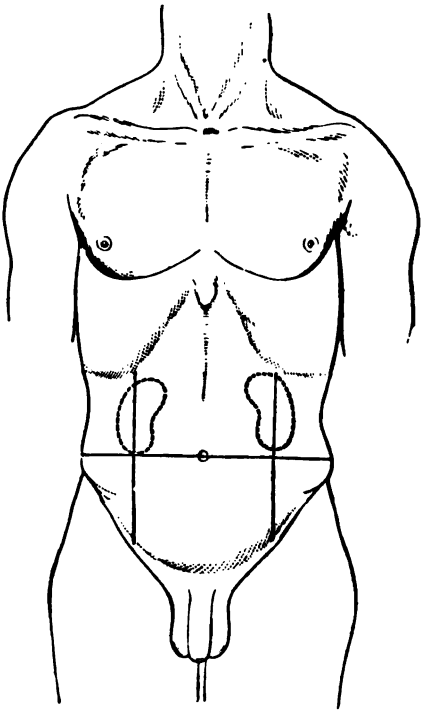


Fig. 1.—Relative Position of Kidneys to front surface of the Abdomen.

line carried upwards to the costal arch from the middle of Poupart's ligaments has one-third of the kidney to its outer side; and two-thirds to its inner side, *i.e.* between this line and the median line of the body.

On the posterior surface of the body its boundaries are indicated by the following: (1) A line parallel with and one inch from the spine between the lower

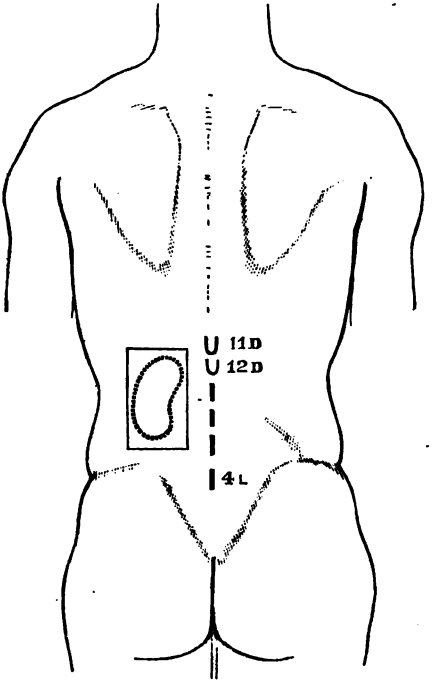


Fig. 2.—Relative position of Kidneys to posterior surface of the Body.

edge of the tip of the spinous process of the eleventh dorsal vertebra and the lower edge of the spinous process of the third lumbar vertebra.

(2) A line from the top of this first line outwards at right angles to it for 2¾ inches.

(3) A line from the lower end of the first transversely outwards for 2 ¾ inches.

(4) A line parallel to the first and connecting the outer extremities of the (2) and (3) lines just described. (*See* Fig. 2.)

The structures which cover the posterior aspect of the kidney within this space are the following, enumerated in their order from without inwards.

(1) After reflecting the skin, the superficial fascia is exposed, and ramifying in it are the external branches of the posterior primary division of the eleventh and twelfth dorsal, and first, second, and third lumbar nerves; the posterior branches of the lateral cutaneous offsets of the tenth and eleventh dorsal nerves; and some small cutaneous branches from the intercostal and lumbar arteries which ramify with the corresponding nerves.

Beneath these is the deep fascia.

(2) After removing the deep fascia, the aponeurosis and some of the lower posterior fleshy fibres of the latissimus dorsi muscle appear.

(3) Beneath the latissimus are (*a*) the serratus posticus inferior, the fibres of which take an outward, forward, and upward direction from the spines of the vertebræ to the lower ribs; (*b*) the posterior layer of the aponeurosis of the transversalis muscle, which, together with the aponeurosis of origin of the latissimus dorsi and serratus posticus inferior, constitute the fascia lumborum; (*c*) to the outer edge of the fascia lumborum which itself corresponds to the outer edge of the erector spinæ muscle, are the fleshy origins of the internal, and the posterior free edge and the fleshy origin from the twelfth rib of the external oblique muscles of the abdomen; (*d*) all the twelfth rib except its head, the external intercostal muscle between it and the eleventh rib, and about two inches of the

eleventh rib near its angle, and also a triangular area of the tenth intercostal muscle.

(4) The erector spinæ muscle: beneath and to the outside of this muscle the middle layer of the posterior aponeurosis of the transversalis abdominis, and externally to this again the undivided aponeurosis, and the fleshy fibres of the transversalis muscle. Piercing the aponeurosis of this muscle at its outer part is the anterior primary branch of the last dorsal nerve and its accompanying vessels. The first lumbar artery gives off a branch which pierces the deep fascia and runs along the outer border of the erector spinæ in the groove between that muscle and the quadratus lumborum. This branch is often of considerable size.

(5) After removing the erector spinæ muscle and the middle layer of the transversalis aponeurosis and some of the fleshy fibres of the transversalis, we see the trunks of the last dorsal nerve and its accompanying vessels, and the abdominal branches of the second, third, and fourth lumbar arteries and veins, the levator costæ of the twelfth rib, the tips of the transverse processes of the three upper lumbar vertebræ, and the posterior surface of the quadratus lumborum on which the lumbar arteries rest. The lumbar arteries, as a rule, pass behind the quadratus, but now and then one or other of them passes on the front aspect of that muscle. The edge of the quadratus often extends far beyond the outer edge of the erector spinæ and is well seen without disturbing the sacro-lumbalis or ilio-costalis muscle.

(6) In front of the quadratus lumborum is the anterior layer of the posterior aponeurosis of the transversalis muscle; and in front of that again is the perinephric adipose tissue, the tunica adiposa of the kidney.

(7) On removing or opening up the tunica adiposa, the whole of the posterior surface of the kidney, the

pelvis of the kidney, and the commencement of the ureter are exposed. For this purpose, however, it is necessary to drag the lower ribs upwards with the tips of the fingers; but the removal of the ribs is not requisite unless the ilio-costal interval is unusually contracted. It is common to find arterial twigs from the renal artery piercing the capsules of the kidney, and ramifying in the adipose tissue, where they anastomose with branches of parietal vessels. Some of the renal branches equal in size a lumbar artery.

Crossing the posterior surface of the kidney obliquely from above downwards and outwards are the anterior branches of the last dorsal nerve and 1st lumbar vessels; and the ilio-hypogastric and ilio-inguinal nerves. To the inner side of the kidney, *i.e.* between it and the spinal column, is the psoas magnus muscle.

Posterior to as well as above the upper part of the kidney is the diaphragm and its origin from the ligamentum arcuatum externum, and from the eleventh and twelfth ribs. The pleura lining the eleventh and twelfth ribs and overlying the neighbouring part of the diaphragm, and, in deep inspiration, the wedge-shaped edge of the lung, intervene between the surface of the body and the back of the left kidney at its upper end.

Below the right kidney, and below and to the outer side of the left kidney, is the colon, in connection with which the arteries and veins from and to the superior and inferior mesenteric trunks can be traced. The right kidney is in contact with the under surface of the liver, upon which it makes a slight depression; and the left kidney touches the spleen as described above.

The fibrous tunic of the kidney is a thin, smooth, but firm and closely fitting envelope. Numerous fine elastic fibres enter into its construction and give it considerable power of stretching and contracting,

according to the degree of vascular tension of the organ.

This thin capsule adheres by minute processes of connective tissue and capillary vessels to the substance of the kidney, from off which, in a healthy organ, it can, however, readily be stripped. Beneath the capsule there is an imperfect layer of plain muscular fibres.

The capsule, following the fissure or hilum in the renal substance, passes into the sinus of the kidney so as to become continuous around the bases of the papillæ of the pyramids with the strong external fibrous and elastic tissue of the calyces and pelvis of the ureter.

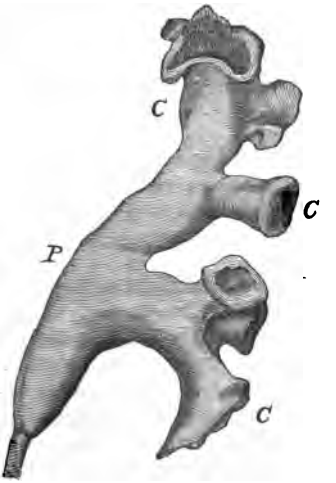


Fig. 3.—Cast of the Interior of the upper end of the Ureter. (Henle.)
U, Ureter; P, pelvis; C, calyces.

If the ureter is traced upwards it is found to lose its cylindrical form on a level with the lower end of the kidney, where it begins to expand into a large funnel-shaped dilatation known as the *pelvis*. After entering the slit or hilum in the renal substance, the pelvis divides within the sinus of the kidney into two or sometimes three primary tubular branches, which, in turn, end in several short truncated but rather wide pouches, named *calyces* or *infundibula*, the mouths of which receive the papillæ. The calyces are connected

with the bases of the papillæ in the following manner. The external fibrous tunic of each calyx is continuous, as just stated, with the fibrous tunic of the kidney; the circular fibres of the muscular or middle tunic of the ureter and its calyces terminate by forming a circular muscle around the papillæ at the level of the mouth of the calyx, whilst the longitudinal muscular fibres cease near the mouth of the calyx and do not quite reach the papillæ; lastly, the internal or mucous coat of the calyx, or at least its epithelium, is reflected over the papillæ to become continuous with the lining of the uriniferous tubes of the pyramid which open on the surface of the papillæ. A single calyx often surrounds two or it may be three papillæ, so that the calyces are less numerous than the pyramids of the kidney. The sinus of the kidney is occupied also by the main branches of the renal vessels, and by a quantity of fat; this fat fills up the spaces between the calyces, and serves as a soft and elastic bedding for them and for the vessels of the kidney.

The relation of the structures at the hilum of the kidney, i.e. of the structures which form the pedicle of the kidney.—Besides the dilated upper end or pelvis of the ureter, the renal artery and vein, a quantity of connective tissue, and a large number of lymphatics and nerves enter into the formation of the pedicle.

The *renal artery* is of large size; large out of all proportion to the size of the organ it supplies. It arises from the aorta a little below the superior mesentery artery, the right taking origin generally a little lower down than the left. Owing to the position of the aorta on the left of the middle line, the artery of the right kidney is longer than the left and crosses behind the inferior vena cava. Before reaching the hilum of the kidney each artery divides into four or

five chief branches, which sink into the sinus behind the corresponding branches of the renal vein and in front

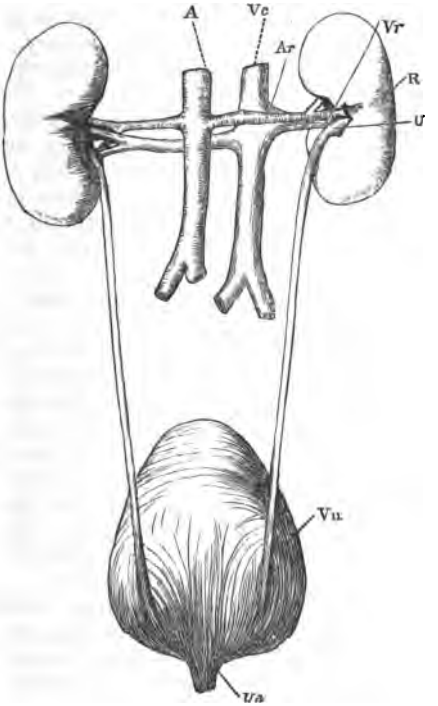


Fig. 4.—The Female Urinary Organs from behind (Henle).

R, Right kidney; U, commencement of ureter; A, aorta; Ar, the right renal artery; Vc, vena cava; Vr, right renal vein; Vu, urinary bladder; Ua, commencement of urethra.

of the pelvis of the ureter (Fig. 4). Deeply in the sinus of the kidney these branches break up into a number of smaller vessels which leave the sinus between the

calyces to enter the substance of the kidney between the papillæ. Before entering at the hilum the artery gives off one or two small branches to the suprarenal body and to the ureter, and several twigs to the fatty and connective tissue around the kidney. Some branches of the renal artery pierce the capsule of the kidney to supply the circumrenal tissue. The *renal vein* is a short wide vessel which, like the artery, takes an almost horizontal course. Its primary branches, four or five in number, issue from the hilum in front of the branches of the artery, and then the vein continues in front of the renal artery till it joins the vena cava. The vein from the right kidney is usually a little lower down than that from the left, but the left vein is longer than the right and usually crosses in front of the aorta to reach the vena cava. The left renal vein is joined by the left spermatic vein; both right and left renal veins receive branches from the suprarenal capsule of their own side. The *lymphatics* of the kidney are very numerous. The superficial set form a plexus in the fibrous capsule. The deep ones issue from the sinus with the blood-vessels.

The nerves consist of filaments from both the sympathetic and cerebro-spinal systems. They accompany the renal arteries and are derived from the renal plexus and the lesser splanchnic nerve.

The connective tissue forms a packing for the other structures in the renal pedicle. Peritoneum covers the front surface of the pedicle, and sometimes, as in the case of floating kidney, more or less surrounds it.

The ureter.—The manner in which the ureter is connected with the kidney, and the relations of this tube at the hilum, have just been described. We have now to consider the course of the ureter, and its anatomical connection with the bladder.

The pelvis, formed by the union of the calyces, is directed downwards and inwards from the hilum,

and after becoming gradually contracted assumes a cylindrical form opposite the lower end of the kidney. Thence it is called the ureter proper. (*See* Fig. 3.)

The ureter measures from 14 to 16 inches in length in the adult, and is about the size of a goose-quill. The lumen of the tube is by no means uniform.

As the ureter passes downwards and inwards to the brim of the pelvis it lies immediately behind the peritoneum, and has but a very loose connection, by means of cellular tissue, with the parts on which it rests. These parts are from above downwards: (1) The psoas muscle and the genito-crural nerve; (2) the common iliac vessels on the left side, and the external iliac vessels on the right side; (3) it then enters the fold of peritoneum forming the posterior false ligament of the bladder; and (4) in this fold it runs downwards and forwards by the side and base of the bladder, below the level of the obliterated hypogastric artery, and enters the bladder wall at a distance of nearly 2 inches from the ureter of the other side. It traverses the wall of the bladder obliquely for a distance of three-quarters of an inch, and opens on the inner surface of that viscus by a narrow slit-like orifice, one inch distant from the orifice of the opposite ureter, and rather more than an inch behind the urethra.

In the upper part of its course the ureter is crossed by the spermatic vessels which descend in front of it. The right ureter courses along close to the inferior vena cava until it crosses the iliac vessels behind the point at which the ileum terminates in the cæcum.

In the female the ureters have to pass by the neck of the uterus before reaching the side of the bladder; only an interval of from ¾ of an inch to an inch, filled up by connective tissue, exists between the uterus and the ureter. In the male the vas deferens passes backwards and downwards, between the side of the bladder and the ureter.

The walls of the ureter are composed of three coats: (1) an external fibrous coat, in which there is a quantity of elastic fibres; (2) a middle coat of plain muscular fibres arranged in two layers, a circular and longitudinal layer; and (3) a mucous membrane which is continuous above with the lining membrane of the tubules of the kidney, and below with that of the bladder.

The mucous membrane consists of areolar tissue, somewhat loose in texture next the muscular tissue, and an epithelium which resembles the bladder epithelium.

A few mucous glands have sometimes been found scattered along the ureter and in its pelvis; they are not always present in man, though, on the other hand, they sometimes become enlarged into mucous cysts.

With the exception of the orifice itself, the interparietal portion is the narrowest part of the ureter.

After the ureters have pierced the outer and middle muscular strata of the bladder, the fibres of their own muscular coat are disposed, according to Ellis, as follows: the internal, the most numerous, are directed transversely, and unite with the corresponding fibres of the opposite ureter; whilst the remainder join the submucous muscular layer of the bladder, and are directed obliquely downwards over the "triangular space" to the submucous strata of the urethra.

According to Sir Charles Bell, on dissecting off the inner coat of the bladder two strong fleshy bands (**the muscles of the ureters**) are seen to descend from the orifices of the ureters towards the urethral opening. Just behind the prostate these bands are well marked and fleshy, and after uniting with one another become tendinous, and are inserted into the lower and back part of the middle lobe of the prostate.

As the ureters lie in the vesical wall they are much nearer to the inner than the outer surface of the bladder; the muscular coat being posterior to them.

Irregularities of the renal arteries.—These are so common that some deviation from the regular condition is to be expected in three cases out of every seven. The variations have reference to the number, origin, branching, points of entrance into the kidney, and, lastly, to the distribution of branches to parts around.

It is much more common for the arteries to be increased than decreased in number, but both renals have been seen arising from a common stem from the front of the aorta (Portal).

Multiple arteries are derived either from the aorta; or suprarenal; or lumbar; or internal, external, or common iliacs; or from the middle sacral; the right hepatic; or the colica dextra.

Renal arteries may enter the kidney on either surface, or at either extremity; but usually all the vessels pass in at the hilum.

From the renal artery branches may be given off to the suprarenal capsule; to the diaphragm or its pillars; or to the colon, pancreas, right lobe of the liver. A branch to the testis may supplant the normal spermatic artery.

The above variations occur *unassociated* as well as associated with malformations and misplacements of the kidney.

REFERENCES.

Sir C. Bell's account of the muscles of the ureters in the Roy. Med.-Chir. Trans., vol. iii., 1812.
Viner Ellis: Roy. Med.-Chir. Trans., vol. xxxix.; 1856.
Quain's "Anatomy," 9th edition.
Holden's "Landmarks."
Carrington's "Manual of Dissection." [1883.
J. B. Roberts: *Am. Journal Med. Sciences*, pp. 402—407; April,
W. H. A. Jacobson and R. J. Pye Smith: *Students' Journal and Hospital Gazette*, March 13, 1875.
A. Macalister: "Multiple Renal Arteries," in the *Journal of Anatomy and Physiology*, vol. xvii., p. 250; 1882-83.

CHAPTER II.

MISPLACEMENTS OF THE KIDNEY.

THE study of misplacements of the kidney is important to the clinical physician and practical surgeon who desire to escape errors in diagnosis and catastrophies in operating. Such misplacements give rise to abdominal tumours, sometimes difficult to diagnose. Thus it is necessary to remember that the kidney is not always situated within the normal limits of its anatomy. It is not very unfrequent for one or both kidneys to be somewhat misplaced, either as regards its distance from the spine, or its relation to the diaphragm above, or iliac crest below. Misplaced kidneys are very often somewhat misshapen. The kidney may be movable as well as misplaced. M. Rayer, who was the first to give a satisfactory account of this subject, divided misplacements of the kidney into two groups: namely, those in which the misplacement is permanent, or, in other words, in which the kidney is fixed in an abnormal position; and those in which the misplacement is not permanent, that is, where the kidney is movable as well as misplaced. Subsequent writers have grouped these cases under three headings, namely, "simple misplacement," "movable kidney," and "floating kidney." In the simple misplacements the kidney may be higher or lower, nearer to or farther from the spine than usual, or may have its axes and borders altered in any direction, or may be turned over upon its anterior surface, but yet thoroughly fixed in its position, whatever the limits of that position may be. A kidney is "movable" when, though appreciably mobile to a

greater or less extent, it is situated entirely behind the peritoneum. It is "floating" when the peritoneum so completely envelopes it as to form a mesonephron, and thus allows the kidney to float or drop forwards, or to be moved in an upward or downward, or, indeed, in any direction.

Simple misplacements may be either congenital or acquired.

A. *Congenital.*—Amongst the permanent misplacements of the kidneys the most frequent are the horse-shoe kidney; after the horse-shoe variety the most common misplacement is into a position over the sacro-iliac synchondrosis or the promontory of the sacrum, or just below the bifurcation of the aorta. In such cases it is common for the renal artery, or one of the renal arteries, when there are more than one to the same kidney, to be derived from the aorta close to its bifurcation, or from the common iliac artery of its own, or even of the opposite side. The suprarenal capsule is by no means always ,though it is occasionally, misplaced along with the kidney; it was so in three out of eight cases observed by Dr. David Newman.

Cruveilhier states ("Descriptive Anatomy") that "when the kidneys are situated higher than usual, the capsules are placed on their inner side, and correspond with the renal fissure; when the kidneys occupy the pelvic region, the capsules do not undergo the slightest change in their position, and no longer have any connection with them."

In many instances the misplacement is but slight, and might be overlooked unless careful post-mortem observation be made; such cases have no clinical significance. But when the kidney occupies the iliac fossa, or rests on the promontory of the sacrum, between the rectum and bladder, or by the side of the uterus, grave complications and troubles may be caused.

In women, such malpositions have given rise to

serious obstruction to parturition, and to great suffering at the menstrual periods, owing to the contact of the misplaced kidney with the ovary (Polk's case).

It is more frequent for one kidney to be misplaced than for both, and the left is much more commonly at fault than the right. Durham records four cases of simple misplacement which had come under his own knowledge. These were all congenital; in three the left kidney was involved, and in one the right. In each, the kidney lay over the corresponding sacro-iliac synchondrosis, and extended more or less into the true pelvis in front of the sacrum or its promontory. In two of them the kidney was misshapen as well as misplaced. Mr. Durham says, "Thus within two years four cases of misplacement of the kidney have fallen under my observation. Such abnormalities, therefore, cannot be extremely rare. At the same time, it must be stated that on searching through the records of more than 1,600 post-mortem examinations, made at Guy's during the last few years, I have only been able to find the two cases quoted above." The sex of the two Guy's cases is not given. The other two cases recorded by Durham (both men) were not in Guy's Hospital. To this statement I may add, that during the ten years ending 1883, among the post-mortem records of the Middlesex Hospital, containing 2,610 examinations, there was but one instance of misplaced kidney. It was in a lad, aged nineteen years, who died of chronic Bright's disease; the left kidney was situated upon the common iliac vessels. During the ten years ending 1882, the Guy's Hospital post-mortem records contain the accounts of 4,632 examinations, and amongst them there are seven instances of misplaced kidneys. The analysis of these seven cases is as follows: Three in men, three in women, and one in a child aged eight months, who had both kidneys misplaced into the pelvis. Two were left kidneys, one

in a man, one in a woman; three were right kidneys, two in women, one in a man; in the child both kidneys were separate; in one case (a man) the two kidneys were united, and rested on the promontory of the sacrum; the union was not horse-shoe-shaped. In two instances the misplacement was acquired; once owing to enlargement of the liver and tight lacing, the right kidney was displaced downwards, and turned completely over; and once owing to the drag of a large renal cyst in a woman, whose liver was enlarged and contained a withered hydatid cyst. In one case the right kidney was malformed and misplaced on to the psoas muscle at the brim of the pelvis, and was lying on its back. In another case (man, aged forty-five) the right kidney was below the brim of the pelvis; and another (man, aged twenty-six) the left kidney was lying chiefly below the brim of the pelvis, in the depression between the psoas and the vertebræ, and it could be pushed so far upwards that half of it came to be above the pelvis. Putting these several figures together, there are seen to be over 8,842 post-mortem examinations yielding ten instances of misplaced kidney. We may, therefore, expect on the average to find at least one out of every thousand bodies containing a misplaced kidney.

Sometimes the misplaced organ is abnormal in size, or form, or as respects its ureter or blood-vessels; and some deviation of the large intestine from its normal position has been frequently found associated with the misplacement of the kidney, more especially of the left kidney. When the left kidney occupies the iliac fossa, or is situated over the left sacro-iliac synchondrosis there is generally no sigmoid flexure in the left iliac fossa; but the descending colon passes across the middle line, and the rectum commences on the right side of the sacrum. These peculiarities in the origin and connections of the blood-vessels and ureters,

and the malpositions of the large intestine which are found associated with misplaced kidney, suggest, if they do not prove, the congenital nature of the misplacement.

In structure the misplaced organ is, as a rule, quite normal.

B. *Acquired.*—Simple misplacements result from pathological enlargements of neighbouring organs, such as the liver, spleen, pancreas, and suprarenal bodies; and from the pressure of tumours. Laennec saw a right kidney which had been jammed down to opposite the iliac crest by the liver. Tight lacing is sometimes the cause of downward displacement of the kidney. The right is more frequently affected than the left, because the liver is less able to resist the compression than the organs in the left hypochondrium. In this way the head of the right kidney gets sometimes dislocated from its position between the liver and diaphragm, and the whole organ becomes turned, so that its long axis is in the antero-posterior direction, with the upper end projecting forwards between the liver and the colon. Such a kidney may be movable, and it is said sometimes to have compressed the colon or vena cava. Wilks and Moxon have seen the kidney in this position, but there were no ill effects in their cases.

In one of the Guy's cases (No. 417, 1874) above referred to, the liver was large, contained two masses of cavernous tissue, and was much pushed down by tight lacing. The right kidney was displaced downwards and inwards towards the median line, turned completely over, and lying on the psoas and spine, with its anterior surface posteriorly, and the ureter running downwards and inwards in front of the kidney. Its position was oblique from above downwards and outwards; its upper end, being behind the duodenum, pushed that part of the gut well forwards from the

spine; the lower end came to the surface between coils of the small intestine; the colon was below the kidney. The kidney was not easily moved upwards or downwards, but was easily replaced in its natural position as regards its surfaces, anterior and posterior, and it could also be brought into a line with the long axis of the body. (This is case iv. in the Report of the Committee of the Pathological Society, vol. xxvii. of the Transactions, p. 472.)

The kidney may be displaced in an upward, or downward, or lateral direction; or it may be rotated upon itself so that the hilum looks upwards, outwards, directly forwards, or backwards. Ruysch has figured a right kidney with its hilum above, and its convex border below, and its ureter passing behind the kidney. It occurred in a woman, aged forty, who died of heart disease with pleuritic and peritoneal effusions. A good example of acquired misplacement is amongst those in the Guy's Hospital case books (No. 247, 1879). A woman, æt. fifty-seven, who died of phthisis, had in her liver a cured hydatid, the size of a Tangerine orange. The left kidney was displaced on to the brim of the pelvis by a large cyst in its lowest part, which contained a pint of yellow fluid. The fluid had an urinous odour, and there were echinococci in it. It does not seem to have been examined for urea or the salts of urine. The cyst had dragged the kidney down; and the cyst itself occupied the greater part of the pelvic cavity. The glandular substance of this kidney and all the rest of the urinary organs were normal, except that the other kidney (the right) only weighed three ounces. An instance of misplacement upwards of the right kidney above the level of the last rib, probably the consequence of perinephritis in very early life, will be described in the chapter on "malformed kidneys."

The acquired, like the congenital misplacements of

the kidney, have been mistaken for abdominal tumours.* They have also been known to obstruct or otherwise complicate labour; but, as a rule, the malpositions which are unattended by mobility of the

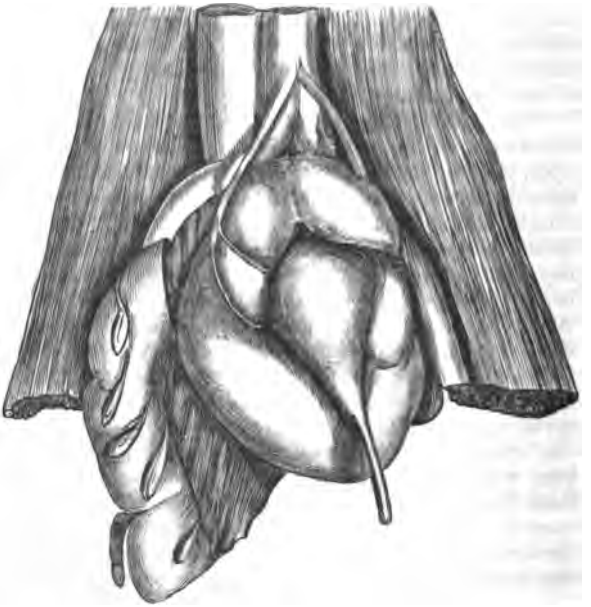


Fig. 5.—Figure representing the lobulated appearance of the Kidney, and its relations to the Aorta and Sigmoid Flexure of the Colon.

Misplaced and malformed left kidney. Misplaced sigmoid flexure of colon. (Canton, Path. Trans.)

kidney, are only discovered on post-mortem examination, and give rise to no symptoms during life. A calculus, even of considerable size, may be impacted in the ureter of a misplaced kidney, and give rise to

* *See* chap. v. on "malformed kidneys."

no symptoms whatever. Such a case is recorded in the Path. Trans. (vol. xiii., p. 147), by Mr. Canton. A man, aged twenty-seven, died of bronchitis; there had been no renal symptoms throughout his life; the right kidney was in all respects normal; but the left was situated below the bifurcation of the aorta, and between the common iliac arteries; it was lobulated and of a rudely oval shape, with its pelvis directed forwards, and dilated, owing to the impaction of an oxalate of lime calculus, which weighed two and a half drachms, in the upper part of the ureter (Fig. 5).

In Bindley's case, quoted by the Committee of the Pathological Society of London, an uric acid calculus, weighing 100 grains, was found in the pelvis of a misplaced and very "movable" right kidney; but there is no mention made of any renal symptoms during life referable to the misplacement, mobility, or calculus.

When occupying a position within the pelvis the misplaced kidney may be discovered accidentally by vaginal or rectal examination. In this event it has to be distinguished from a morbid growth or an inflammatory swelling; and the diagnosis will rest chiefly on the size and growth and elastic character of the misplaced body, and in the want of the usual fulness and resistance in one or the other of the loins. If the swelling has a reniform outline, the diagnosis will be facilitated. But, as in congenital misplacements, frequently, and in the acquired cases, when the misplacement is due to an alteration in the organ itself, the kidney has not the usual form, the want of the characteristic outline must not unduly influence the diagnosis.

If the degree of suffering caused by the misplaced kidney necessitates surgical treatment, nephrectomy will in most cases be the only available resource, unless it be possible to fix the kidney in a position in

which it will cease to cause pain. It is, however, quite exceptional for simple misplacement of the kidney to need any treatment at all.

CHAPTER III.

MOVABLE KIDNEY.

The movable kidney is distinguished from the floating kidney by the absence of a mesonephron. The "floating kidney" is covered with peritoneum, and floats within the abdominal cavity, like the coils of small intestine. The "movable kidney" is entirely shut out from the cavity of the peritoneum, and occupies a position between the peritoneum in front and the muscular parietes behind; but within this position the kidney moves more or less freely and widely.

Pathological anatomy.—Sometimes the adipose capsule of the kidney is large and loose, and permits of the movement of the organ within it; in other instances the adipose capsule closely surrounds the kidney, and moves with it; whilst in others again the kidney moves within its adipose capsule, and the capsule also moves about with the kidney behind the peritoneum. The structure of the kidney is normal; or if it be not so, the pathological change in it is entirely independent of the mobility. Movable kidney is generally acquired, whereas floating kidney is always congenital. There is, however, an intermediate variety, which is congenital, but more allied in its pathological anatomy to the movable than to the floating kidney. In this intermediate form there is no mesonephron, and owing to some irregularities in

the arrangement of the peritoneum the kidney is not even covered on its anterior surface by the peritoneum, but is unsupported and free to move between diverging processes of the peritoneum. The following case contained in Mr. Durham's article in the Guy's Reports, 3rd series, vol. vi., p. 413, is one in point:

Upon opening the abdomen of J. C., a female, æt. thirty-four, Mr. Durham observed that the left kidney was remarkably prominent, and not exactly in its proper place. The descending colon also was much nearer the middle line than usual, and instead of forming the sigmoid flexure in the left iliac fossa, it turned across the lumbar vertebræ, and passed down into the pelvis on the right side of the sacrum. Upon slightly pressing the kidney it slipped into its ordinary situation; and upon further examination it was found to be movable, with extreme facility, to a most remarkable extent. By different changes in the position of the body, or by gentle manipulation, the kidney was with equal ease caused to pass up under cover of the ribs, across on to the bodies of the vertebræ, or even somewhat to their right side, and down into the iliac fossa. Upon closing the abdomen, and manipulating the lumbar region, the kidney felt like a smooth, oval semi-elastic tumour, and slipped from between the fingers when compressed. It was at once manifest that the mobility of the kidney in this instance depended in great measure upon the abnormal arrangements of the peritoneum, necessarily associated with the malposition of the colon. So far, therefore, it must be regarded as having been congenital. When traced from the side of the vertebral column, the peritoneum, instead of passing over the anterior surface of the kidney, only just touched the lower part of its inner border, and there having formed the descending mesocolon, again touched its outer border. The lesser

sac of the peritoneum also, instead of being confined to its ordinary limits, passed so far to the left as to cover the posterior surface of the spleen, and so far downwards as to touch, and be reflected from, the upper border of the kidney. Thus there was no distinct mesonephron; but the kidney, instead of being supported and kept down by a single layer of peritoneum, was left free to move between and beneath three diverging layers. Upon dissection, it was further found that there was scarcely any fat in the lumbar region, but a quantity of very loose areolar tissue. The renal vessels had their ordinary sources and connections; they were perhaps rather larger and thinner than usual. The left suprarenal capsule moved only to a very limited extent with the kidney.

The vessels of the kidney may be elongated, but in other respects are, as a rule, normal. An abnormal origin of the artery of a movable kidney suggests the congenital nature of the mobility. The suprarenal capsule commonly does not move with the kidney, and, except as regards its relation to the kidney, occupies its natural situation in the body.

The extent of movement varies greatly. A slight degree, *i.e.* an inch or thereabouts, upwards or downwards appears not to be rare; and is easily detected by handling the kidneys as soon as the abdomen is laid open, and before any of the viscera are removed. In other instances there is a much greater range of movement; and occasionally, owing to the flaccidity of the peritoneum, the degree of mobility is as considerable as though the kidney possessed a long and loose mesonephron.

The peritoneum may be sufficiently loose to allow the kidney, moving behind it, to leave its natural position and fall below the brim of the pelvis, or as far forwards as the anterior abdominal parietes, or across to the opposite side of the spinal column. In the

Report of the Committee of the Pathological Society of London mention is made of one instance in which the kidney moved under the peritoneum through a space described as a circle with a diameter of eight or nine inches.*

It is evident, therefore, that the greatest freedom of movement does not of itself indicate that the kidney possesses a mesonephron, or that the peritoneum covering the kidney is in any way abnormal except in the greater laxity of its attachments to the subperitoneal fatty tissue of the loin. A movable kidney having as great a range of movement as a floating kidney may give rise to all the same clinical features. The terms "movable" and "floating" are not therefore intended to imply *different degrees of mobility;* but different anatomical conditions, which have a real significance when operative treatment is contemplated for the relief of the suffering to which mobility of kidney sometimes gives rise. In the majority of instances of "movable kidney," however, the degree of mobility is but slight.

Etiology.—Naturally each kidney, but more especially the right, moves slightly in respiration owing to the contraction and descent of the diaphragm. Movable kidney is more common in females than in males. Skorczewsky states that in 1,422 patients which he examined during life, 32 females out of 1,030, and three males out of 392, were the subjects of mobility of kidney. But it is hardly necessary to say that inferences drawn from clinical examination of the abdomen do not carry with them the conviction of post-mortem inspection. On the one hand, it is impossible to say after palpation that the kidney is absolutely immovable; whilst on the other, the diagnosis of movable tumours of the abdomen is admittedly difficult; and in many instances what

* Dr. Bindley's case; Path. Soc. Trans., vol. xxvii., p. 473.

has been positively asserted to be a mobile kidney during life has, on post-mortem examination, or on the operating table, turned out to be something very different. It is, however, far from uncommon to find after death that a kidney is mobile, though it was not known to be so during life. It is certain that the proportion of women affected is greatly in excess of the males, and this more especially in the severer forms of mobility. The right kidney is from twelve to thirteen times more often affected than the left. The reasons assigned for the greater frequency of the mobility of the right kidney are the weight of the liver, its little proneness to yield to tight lacing, and its descent with every act of deep inspiration; the greater length of the right renal vessels; and the fact that the ascending colon is less firmly bound to the right kidney than the descending colon is to the left. Both kidneys are involved about once out of twenty cases (Landau). Schiff, Heslop, Wiltshire, G. Hunter, and others, have recorded cases of mobility of both kidneys, and of double kidneys.

Between 80 and 90 per cent. of the cases occur between the ages of twenty and fifty, the greater proportion of them being between the thirtieth and fortieth years.

In women the affection most commonly arises during the child-bearing period, and just subsequent thereto. Pregnancy has a great share in its production, and a very large proportion of the cases occur in women who have borne children quickly or numerously.

The way in which pregnancy conduces to movable kidney is (1) by the sudden loss of intra-abdominal pressure after delivery; (2) by the forcible contractions of the diaphragm during parturition and the consequent downward pressure more especially exercised on the liver and right kidney; (3) by the subsequent

loss of muscular resistance in the abdominal walls and in their pendulous flaccidity after parturition; and (4) by the too early resumption after delivery of the erect posture, and of physical occupation, without wearing proper abdominal support. It is amongst the poorer classes that the movable kidney is more often found, and the last-mentioned cause is the explanation of this fact. It has been repeatedly stated by those who have had good opportunities of judging, that at least 10 per cent. of the poor women of Austria and of Holstein who have borne children have a movable kidney.

Becquet believes that the kidneys are associated with the generative organs in the congestion which affects them during menstruation; and that in this way their displacement is the consequence of the changing volume and weight of the kidney. In the same way he explains the renal pain which is so often felt at the menstrual periods, especially by those subject to dysmenorrhœa. Certain it is that there is an increase during menstruation in the severity of the symptoms, and in the sense of weight and dragging experienced by some women with movable kidney. Whatever causes a pendulous state of belly conduces to mobility of the kidney; and Landau has pointed out that at least half the patients have prolapse of the uterus or vagina, or cancer, or retroflexion of the uterus, hernia, or some weakness or laxity of the perineum or abdominal walls.

Rapid general emaciation and the absorption of the fatty elements of the adipose capsule of the kidney even in persons not emaciating in other parts of the body; as well as a primative deficiency of the perinephric fatty tissue, favour, if they do not determine, the mobility of the kidney.

Riolan, writing in 1682, said, "The cause of this" (displacement and falling forwards of the kidneys)

"arises, not only from the diminution of the fat with which they are enveloped, but also from the fact that, having become too large and heavy, in consequence either of tumours developed in them, or of stones included in their pelvis, they are borne down by their own weight." The latter part of Riolan's explanation may account for the not very rare association of movable kidney and hydro-nephrosis. Tight lacing, by the intermittent compression of the waist by a corset, is another probable cause. Cruveilhier states that he has often observed the right kidney to be mobile and likewise displaced a long way from its natural position, in women who have worn tight stays. Mobility may be associated with the misplacement from this cause. Velpeau discovered a movable kidney in the right iliac region of a woman who subsequently died of peritonitis; the misplacement of the kidney was presumably caused by the drag of a hernia of the cæcum into the femoral sac (Rayer).

Finally, in many instances the immediate cause of the mobility has been of a traumatic nature, such as a blow or kick on the loins, a jerk, or some severe and sudden concussion. A military officer who fell upon his feet from a horse suffered a violent concussion of his entire body, and subsequently both his kidneys became movable (Henoch).

Symptoms.—The symptoms of a movable kidney are of two kinds, viz. the subjective, or those experienced by the patient, and the physical, or those which can be detected by the hand of the surgeon. In the mild cases there is often an entire absence of any sign whatever, and the condition, as has been stated, is only discoverable on post-mortem examination. In cases of a more severe form, but in which, owing either to the stoutness of the patient, or to the movement of the kidney being only in a vertical or lateral direction, no physical signs

are detectable, the subjective symptoms may be acute.

The most characteristic of these **subjective symptoms** are a constant or frequent sensation of dragging and weight in the loin and side of abdomen; an occasional sense of something moving, which sometimes has been described as being as marked as the movements of the fœtus in utero; severe paroxysms of pain resembling nephritic colic, pain of a dull aching character in the loin or abdomen, or neuralgic pains in the course of the great nerves (crural or sciatic) of the thigh of the affected side (Rayer). Vomiting more or less frequent and severe, and sometimes preceded by a burning pain in the epigastrium, is caused by the dragging or pressure of the kidney upon the middle portion of the duodenum; disturbance of the large intestine, sometimes resulting in diarrhœa, sometimes in constipation; loss of appetite; languor, debility, flatulence, and loss of flesh, restless depression of spirits, or a hypochondriacal state is sometimes induced. These symptoms are aggravated by exertion, fatigue, long standing, much walking or sitting; and they are relieved by the opposite conditions, by rest in the recumbent position.

In the female, pregnancy and the menstrual periods are usually occasions of increased suffering; in males and females alike constipation and impaction of hardened fæces in the colon add to the patient's distress.

The urine is healthy in character, and as a rule is voided in a normal way. If it is habitually albuminous, the albumen will be due to some pre-existing or co-existing independent disease. Increased frequency and urgency of micturition have been noticed in some cases, but these symptoms have been generally brought on or increased by long

standing or much walking (Henoch); or by the pressure of the kidney towards the pelvis, and probably upon the bladder. In some of the recorded cases the movable kidney has subsequently become hydro-nephrotic, and the connection, as cause and effect, between these two conditions is not hard to seek. When the kidney drops forward or downward, as after long standing or sitting, the course of the ureter becomes so deflected and curved upon itself that the urine cannot flow along it; and this temporary obstruction, frequently repeated, leads at length to a permanently distended state of the renal pelvis. It is possible for the kidney to be so altered in position that the ureter becomes twisted upon itself, and the flow of urine is completely stopped; in such case atrophy of the kidney, instead of hydro-nephrotic distension, would be the more likely result. Either of these conditions may exist without its being possible to detect it, though the weight of a hydro-nephrotic movable kidney would increase the sense of dragging, and the other subjective symptoms enumerated above.

If renal disease exists, ill consequences are more likely to arise from torsion or flexion of the ureter and vessels of the movable kidney. Newman records a case in which the symptoms of uræmia usually appeared suddenly when the kidney was displaced, and disappeared in from twenty to fifty-six hours. The symptoms consisted of suppression of urine, or great diminution in the quantity excreted, severe pain in the renal regions, sickness, nausea, and vomiting, followed by dimness of sight, severe and persistent headache and lethargy, with occasional paroxysms of excitement. These symptoms were associated with a rapid increase in the size of the movable tumour.

To repeat, in a few words; the usual subjective symptoms excited by a movable kidney are pain,

a sense of dragging weight in the abdomen, sickness, loss of appetite, and other symptoms of dyspepsia, irregularity of the bowels, and possibly, though not probably, some disturbance of the urinary organs.

The **physical signs**, when any such exist, are the presence of a movable tumour of characteristic renal outline, and which on palpation is painful, or gives rise to a peculiar sickening sensation. The movement may be slight or considerable. In several cases the kidney could be pushed upwards under the ribs, downwards into the pelvis, and inwards across the median line. In fact, a movable kidney may have as wide a range of movement as a floating kidney, *i.e.* one which possesses a distinct mesonephron. When the mobility is considerable, the abdominal parietes, which are usually very flaccid, permit of the tumour being quite grasped by the fingers of the surgeon; and the tumour will be found to fall below the margin of the ribs and towards the umbilicus or the pelvis when the patient sits or stands; to roll from side to side according to the inclination of the body; and to be easily pushed back into the loin when the recumbent posture is resumed.

Occasionally there is no recess in the loin to indicate the place vacated by the kidney; on the contrary, fat sometimes accumulates there and shapes itself to the under surface of the liver or spleen, as the case may be. The right lobe of the liver, when enlarged or displaced by tight lacing, may effectually keep the kidney out of the loin. In a case recorded by Dr. Tuckwell the right kidney fell back by its own weight into its proper position as soon as the liver was removed. Such a condition of liver would prevent lumbar nephrorraphy.

Martin, of Berlin, considers the best way of making sure of the renal nature of a movable tumour

in the abdomen is the method of Freund (*see* page 491), *i.e.* to place one hand below the costal margin behind, and press up whilst the other hand compresses the tumour from the front.

It does not generally fall spontaneously into the loin whilst the patient lies on her back, but, on the contrary, has a tendency to rise forwards and towards the median line as soon as the pressure which has thrust it backwards is removed. Respiratory movements as well as the position of the body influence the position of the kidney; deep inspiration forces it downwards, forcible expiration allows it to ascend. When the degree of mobility is but moderate only a part of the kidney may be tangible, and half or three quarters of the organ only will be felt between the margin of the thorax and the umbilicus. The tumour gives a sensation of smoothness and firmness with its extremities rounded; the direction of its long axis is not by any means always the same, but is frequently oblique from above downwards and inwards. Percussion over the tumour gives usually a tympanitic sound, or, as Roberts styles it, "a muffled tympanitic note," owing to the pressure of some coil of bowel between it and the parietes. Percussion over the vacated loin elicits a more or less distinctly resonant note; and there is a sense of deficient resistance in the ilio-costal space. These signs are lost, however, as soon as the kidney is thrust back into its proper position.

It is scarcely to be expected that a "movable kidney" can invariably give a dull percussion note over its anterior surface, because as the kidney is not in the peritoneal cavity, but shut out behind the posterior layer of the peritoneum, there is almost of necessity intestine between it and the anterior parietes.

In exceptional cases the tumour may occupy the

iliac fossa; and there may be great displacement without a tumour being at all felt through the abdominal parietes, as, for example, when the kidney falls behind the bladder or uterus. The pulsation of the renal artery has been observed by some writers; epigastric pulsation, and congestive enlargement of the movable kidney, have been described by others.

Diagnosis.—In examining any unusual tumour of the abdomen the possibility of its being a movable or floating kidney should always be fully taken into account. What is, however, more likely to happen than overlooking or mistaking the nature of a movable kidney, is to mistake something else for one. The conditions most likely to give rise to a mistaken diagnosis in this direction are tumours of the omentum or mesentery. I have known two such cases; the omental origin of the tumour in one of them was proved after death; the other patient is still alive. This latter case is remarkable for more reasons than one. A single woman, æt. 42 (named M. C.), consulted me in 1880 about an operation on her breast which was the seat of cancer. The cancer had been noticed twelve months, and was hard, well defined, in a small breast, and quite free of adhesions either to the skin or submammary tissues. It looked, in fact, of itself a very favourable case for excision of the breast; but as the patient was sallow, thin, and of unhealthy appearance, I was suspicious of internal disease, and I found a small previously undetected scirrhous tumour in the other breast, and a freely movable horse-shoe-shaped smooth hard tumour in the abdomen. She stated that she had had the abdominal tumour for seven or eight years; it was somewhat tender and painful, gave rise to a sickening sensation on palpation, and had not varied in size since first noticed. It was

exactly of such a size and outline as a floating single horse-shoe kidney might be; and it had a narrow vertical depression in the centre over the spinal column suggesting the line of union of the kidney of each side. I thought it must be a movable united renal mass, and others whom I asked to examine it thought so too; but one day when I pressed firmly with my fingers on the vertical groove of the tumour away floated the mass in two halves, one towards each loin, and there arose between them a third irregularly round hard mass the size of an orange; a fourth became defined in the right iliac region. On many subsequent occasions I repeated the same manipulations, always with the same effect, and I came to the conclusion that the masses were fibrous tumours in the omentum. The patient is still (April, 1885) alive; the abdominal tumours, I am informed, are unchanged, but the cancer of one breast has ulcerated and spread widely, that of the other breast has also increased.

Small ovarian tumours are, it is said by some, apt to be mistaken for movable kidney; but this is not very likely to occur if attention is paid to the history; and to the direction in which movement is most easily effected, and that in which it is most resisted.

I have removed a small parovarian cyst holding about eighteen to twenty ounces of clear watery fluid, which seemed to vary its position from time to time though it was shut down by the peritoneum, which passed over it; some days it could be made out from the front of the abdomen, sometimes not; always the percussion note over it was resonant, but always a swelling could be felt per vaginam on one side (left) of and to the back of the uterus, and always the direction of disappearance of the swelling was downwards into the pelvis. The tumour had not increased appreciably in size, but it gave rise to frequent peculiar aching

sickening pain. The absence of the renal outline, the low position, the pelvic connection of the tumour, and the fact that the tumour could not be pressed upwards nor inwards, and more especially not towards the loin, excluded the possibility of its being a kidney, though the shifting position, the invariable resonance over its front surface, the sickening pain excited by pressure, and the want of increase in its size, might have led to confusion but for rectal and vaginal examination.

An ovarian tumour with a long pedicle would have more liberty of movement than a paro-varian cyst, but its preference for the pelvis and its resistance to being forced into the loin when pressed upon, as well as its shape, its tendency to increase in size, and the absence of resonance on percussion over it, would serve to indicate its nature and to contra-indicate a movable kidney.

A distended gall bladder has more than once been thus mistaken, so also has an enlargement of the head of the pancreas. Mr. Lawson Tait has reported a case of distended gall bladder which had been mistaken for a floating kidney "by several distinguished authorities." *

The patient was a female, aged twenty-eight, who had suffered pain in the hepatic region from puberty. The pain varied in duration and degree, was induced by exercise, and thus prevented the patient from dancing or indulging in other physical pastimes, and was generally sudden in its onset.

When twenty-seven years of age a movable tumour made its appearance in the upper and right part of the abdomen, which seemed solid and of the shape of a kidney. It was tender on pressure, and when the hips were raised above the shoulders it could be made to disappear. Sometimes it came

* *Brit. Med. Journal*, Nov. 18, 1882.

below the umbilicus. No jaundice, no abnormal condition of urine existed. A distinguished physician at this time expressed the belief that the tumour was a floating kidney with a calculus impacted in its pelvis. It turned out to be a distended gall bladder filled with a pint of thick glairy mucus and about eighty small gall stones. Cholecystotomy was performed, and the patient made a good recovery.

The points on which the diagnosis in this case rested were that the tumour seemed cystic, and (though its lower part was movable) attached above. Had jaundice existed with these other two symptoms, the diagnosis would doubtless have been made more readily. Lawson Tait adds that out of thirteen cases in which the diagnosis of movable kidney was wrongfully made, seven were proved to be distended gall bladder, four ovarian cystomata with long pedicles, and two were tumours of the pancreas. The point round which a distended gall bladder moves is one near the notch of the liver. The percussion note over a distended gall bladder is dull, the dulness is continuous with the hepatic dulness, the tumour follows the movements of the liver more markedly than a movable kidney, and does not, when handled, give rise to the same peculiar fainting and sickening feeling. In a case recorded by Dr. Lindsay Steven, a floating kidney with a fairly perfect mesonephron was found associated with a gall bladder greatly distended and with its duct occluded by a large calculus. On the other hand, a movable kidney may be (and cases are on record in which it has been) mistaken for a spleen, an hepatic enlargement, a malignant tumour, an intraperitoneal abscess, an ovarian or uterine tumour with exceptionally long pedicle, and other intra-abdominal tumours.

The size and outline of the tumour, its ascertainable attachments, its want of tendency to increase, its

smooth surface, the sickening pain on pressure, the want of resistance in the loin, especially when the patient is on her hands and knees; and the facility with which the movable tumour can be pressed back into the loin, are the features which will guide to a correct diagnosis. If in a tumour, having the size and general form of a kidney, what corresponds to a hilum can be detected, the diagnosis will be assisted. Though it will sometimes be very difficult to avoid error, we must repeat that the diagnosis will often be readily made if only the possibility of a movable kidney be kept in view when examining a doubtful or unusual abdominal tumour.

Treatment.—In many cases the symptoms, if any exist, are so slight that no treatment is requisite. In other cases, in which symptoms are only present after exercise such as riding on horse-back, dancing, long standing, or much walking, such forms of exertion should be abstained from. In cases in which symptoms occur during quietude, exercise will have to be restricted as much as possible, or refrained from entirely. Functional disorders of the bowels, especially constipation, should be corrected; and anæmia and loss of tone of the muscles should be dealt with by appropriate internal remedies.

As there is evidence which seems to justify the conclusion that the absorption of the circumrenal fat, whether as part of a general emaciation or not, is one cause of movable kidney (Newman, Lindsay Steven, Henderson, Oppolzer), it has been proposed, and successfully practised by Dr. Francis Henderson in one case, that the patient, in addition to wearing a belt and pad, should be kept upon a fat-making diet with a view of increasing the natural packing of the kidney. Before adopting this treatment, the surgeon however, should be sure that absorption of the circumrenal fat is at least the most probable primary

cause of the mobility of the kidney in the particular case.

Tight lacing must be avoided, and when the muscular parietes of the abdomen are weak and flaccid, as they commonly are, an abdominal belt or stout closely-fitting jersey should always be worn to support the parietes. If disagreeable or painful symptoms, from the mobility of the kidney, are constantly experienced, a specially fitted pad and belt should be worn to retain the kidney in its proper place. Varying forms of trusses and bandages have been devised for this purpose.

Dr. Smith, of New York, has described and figured in the *New York Medical Journal* (February, 1883, p. 184), a truss having behind four small pads, which rest two on each side of the spinal column, and in front an air pad, which can be distended or emptied by means of a tube without removing the belt, at the will of the patient. The instrument resembles a hernia truss, except that the spring is straight instead of oblique.

Indeed, a stout bandage, provided with a pad like the pad of an umbilical hernia, applied over the kidney, has, in my experience, answered very well in keeping the kidney in its place. Care must be taken, however, to prevent the bandage or truss from shifting its position, and for this purpose brace straps or elastic tissue let into the jean or webbing are useful adjuncts.

Newman, of Glasgow, employs "a well-fitting abdominal elastic bandage, extending from the line of Poupart's ligament to the level of the sixth or seventh rib. The bandage should be made to fit the body accurately and firmly, without exerting undue pressure at any point. It may be made of one piece, or, what I consider much better, of strips of elastic bandage sewn together, and united in the middle line

in front by means of steel slips, similar to those used to fix stays." Before getting up for the day, the patient should slip upwards over the lower extremities a jersey fitting the abdomen tightly, and outside this an air pad should be applied over the kidney after it has been restored to its place, and the broad elastic bandage should be buckled over the pad. A collapsable air pad, which can be inflated by means of a tube and stop-cock after it has been adjusted to the abdomen, is made for the purpose. With this or such-like appliance some patients are made very comfortable, and are rendered capable of taking really a considerable amount of exercise.

Electricity, frictions, the shower bath, and cold douches to give tone to the flaccid abdominal walls, and the recumbent posture, are some of the means which have been resorted to for fixing the kidney in its place. But they are not very successful.

Dr. Hare has recorded a case in which the mobility of the kidney markedly diminished after two pregnancies, probably owing to the gravid uterus acting as a temporary mechanical support to retain the kidneys in their places.

When the symptoms of congestion, or so-called strangulation, of the kidney occur, complete repose in the recumbent posture, hot fomentations to the painful part of the abdomen, and anodynes, especially morphia injections or suppositories, are indicated.

In a certain small proportion of cases the symptoms are so constant and severe, and so little, if at all, relieved by rest and appliances, that some more radical measure is justifiable and requisite. There are two operations which have been employed, viz. nephrorraphy and nephrectomy, for the relief of the sufferings caused by movable kidneys. These operations are described in the chapter devoted to the operations on the kidney. It will be sufficient here to point

out the conditions under which they should be performed for movable kidney. An operation should be advised when the symptoms are severe and not relieved by rest, quietude, and mechanical appliances; when the symptoms, though relieved by rest in the recumbent position, occur in persons who cannot maintain this position, either from the circumstances of their life or from their mental inability to endure the restrictions of such a life; and when mechanical appliances cannot be borne or seem to increase rather than mitigate the symptoms, and the patient cannot move about gently or even sit without suffering. In cases in which, in spite of palliative treatment, paroxysms of nephritic colic, fainting, sickness, vomiting, and pain radiating far and wide in the course of the branches of the lumbar plexus of nerves occur frequently, the only possibility of relief is surgical operation.

Nephrorraphy is to be preferred to nephrectomy, when the movable kidney is sound, or when both kidneys are movable, or when the non-movable kidney is diseased. In one of Hahn's successful cases of nephrorraphy, the kidney, which was not movable, was suspected to contain a calculus; in another case both kidneys were movable.

Lumbar nephrectomy may be performed when the kidney is diseased as well as movable, providing the other kidney is sound; and it may be resorted to after nephrorraphy has failed, as was successfully the case in Gilmore's patient. It may also be performed in cases in which nephrorraphy is out of the question, as in certain cases of misplaced movable kidney, which cannot be pushed back into the loin. In Polk's celebrated case the kidney occupied the iliac region, and though freely movable in all directions, it could not be moved out of the iliac fossa into the loin, and no fixing apparatus was of any use. In fact, the mobility

of the kidney in this case had little to do with the distress suffered; the symptoms were due to the intimate relationship between the displaced kidney and the left ovary.

It ought, however, to be remembered, that though distressingly painful, and serious in its general effects on the patient, a movable kidney is never a cause of death; and, therefore, nephrectomy being employed, as it is in such cases, to give comfort, not to save life, should only be undertaken after great consideration. The risk of the operation, when performed for movable or floating kidney of normal size, is much less than when performed for some organic disease attended with great increase in the size of the kidney, and with adhesions and condensation of the surrounding tissues. Out of thirteen cases in which a healthy movable kidney has been excised, three proved fatal. In each of these three cases abdominal, not lumbar, nephrectomy was performed. In three other fatal abdominal operations the movable kidney was the seat of sarcoma in one, cancer in the other, and fatty degeneration in the third. The mortality of nephrectomy for organic disease has hitherto been more than twice as great as for movable and floating kidney, and other causes, such as ureteral fistula and wounds of the kidney, in which the renal structure is not diseased. The mortality of nephrectomy for these last-mentioned conditions up to the present time has been about twenty per cent.; whereas, after nephrectomy for organic disease of the kidney, it has been fully if not more than fifty per cent.

Nephrorraphy hitherto has been very successful. Besides Gilmore's case, which failed, there have been eight successful cases published: three by Hahn, and one each by Küster, Esmarch, Bassini of Pavia, Weir of New York, and Newman of Glasgow. In all these cases the mobility of the kidney was either

quite prevented or much restricted, and the symptoms were in great part or entirely relieved. The ages of the patients operated upon varied between twenty-seven and forty years. Five of them were females; the sex of three is not stated; but as they were all German cases the probability is that they were women, because of the frequency of movable kidneys in the lower orders of German and Holstein women.

The advantages of nephrorraphy over nephrectomy are so obvious that they perhaps need scarcely to be pointed out. They are the following: (1) The amount of excreting renal tissue remains exactly the same after nephrorraphy; (2) the possibility of there being only one kidney is a matter of no moment; (3) the great mortality of nephrectomy is avoided. Nephrorraphy hitherto has not been marred by a single fatal result.

In selecting lumbar nephrectomy for movable kidney the surgeon is bound to be absolutely sure of his diagnosis. If there is the smallest ground for doubt, the abdominal operation would be alone justifiable, because it affords an opportunity of verifying the nature of the movable tumour before commencing to excise it.

To perform lumbar nephrectomy for what is supposed to be a painful movable kidney, and afterwards to discover that the moving tumour had not been taken away, nor the patient's sufferings relieved, would be as terrible a reflection upon the surgeon as it would be a cruel misfortune for the patient.

CHAPTER IV.

FLOATING KIDNEY.

WHEN a kidney possesses a mesonephron which permits it to move more or less freely it is called a "floating kidney," in contradistinction to a kidney which has no mesonephron, but which moves about behind the peritoneum. Between a "floating" and a "movable" kidney, when the latter has a very free range of mobility it is not possible to distinguish until the abdomen is opened or the kidney explored through the loin.

Floating kidney is always due to a congenital disposition of the peritoneum, and is necessarily associated with an elongation of the renal vessels. In some cases of floating kidney it has been noticed that all the processes of the peritoneum were unusually long. The foramen of Winslow has been found very large owing to the laxity of the gastro-hepatic omentum; the great omentum very large, and the mesocola long and lax. It has also been stated that a movable kidney which for a while had been limited to a slight up and down movement, may by degrees become a floating kidney by the detachment of the peritoneum from the lumbar portion of the abdominal wall; but though the mobility of the kidney does in some instances gradually increase, the arrangement of the peritoneum in such cases is not that of a true mesentery or mesonephron, and therefore, according to the definition here adopted, the term floating kidney ought not to be applied to them. It is not necessary to a mesonephron that the two layers of peritoneum should be in close apposition; they may be even at some

distance apart; but if the peritoneal envelopment moves with the kidney, and not the kidney behind the peritoneum, the serous membrane must be considered to form a mesonephron and the kidney is properly called a floating kidney.

It ought to be mentioned that the distinction between floating and movable kidney has not by all writers been made simply an anatomical one, and hence a certain amount of confusion attaches to the names when indeed they are not applied indifferently to the various conditions. Sir William Jenner* has written, "A floating kidney is a kidney that has a mesentery, a fold of peritoneum attaching it very loosely to the spine; a floating kidney can be moved about to a considerable extent, to the extent of the length of its mesentery. A movable kidney can only be passed up and down a little; it slips a little under your fingers." This would seem to imply that the degree of mobility depends on the presence or absence of a mesonephron; and therefore that a clinical distinction indicates an anatomical difference. The committee of the Pathological Society of London appointed to inquire into the matter of displaced, movable, and floating kidneys, on the other hand, found evidence to show that "the peritoneum may be flaccid and loose to such an extent as to allow the kidney to move under it so as to come in contact with the walls of the belly; or to leave its natural place and pass to or below the brim of the pelvis, or, indeed, in some cases to encroach upon the opposite side of the belly. A like movableness or floating of the kidney may be due to the presence of a mesonephron."

The committee, taking into their consideration the clinical resemblance of all very freely moving kidneys, whether they have a mesonephron or not, and also the fact that "both these anatomical varieties merge by

* *Brit. Med. Journal*, vol. i., p. 43; 1869.

insensible degrees into one another," would style every very mobile kidney "floating," no matter what its anatomical relations to the peritoneum; and every slightly or moderately mobile kidney "movable."

To the surgeon who may have to consider the desirability of performing nephrorraphy or nephrectomy for movableness of the kidney, the anatomical difference between a kidney with and without a mesonephron becomes one of sufficient importance to justify the classification which I have adopted.

A floating kidney is very much less common than a movable one; indeed, it is excessively rare. It has even been asserted again and again that a mesonephron has never yet been observed, and never exists. Those who have made this assertion must have overlooked several important published cases. Dr. William Henderson,* of Clifton, reported a case in which the right kidney was found perfectly movable, and suspended "by a prolongation of the peritoneum enclosing the kidney and forming a distinct mesentery, which allowed it to move in all directions." Dr. Priestley† has recorded a case in which the peritoneum formed a distinct mesentery for the kidney. More recently (in April, 1883) Dr. Lindsay Steven showed a specimen of kidney with a partially formed mesonephron, at a meeting of the Glasgow Pathological and Clinical Society.‡

The line of attachment of the renal mesentery in Dr. Steven's specimen corresponded to the upper half of the internal border, and a small area of the upper portion of the posterior surface of the kidney. The movement of the lower part of the kidney was thus much more free than that of the upper.

In Mr. Keetley's§ case the right kidney of a

* *Med. Times and Gazette*, vol. ii., p. 501.
† Ibid., vol. i., p. 262; 1857.
‡ *Glasgow Med. Jour.*, p. 309; Oct., 1883.
§ Path. Soc. Trans., vol. xxvii., p. 469.

woman, aged sixty-eight, was found on dissection in its usual position, but freely movable in all directions. The two layers of peritoneum, forming what resembled a mesentery, were independent of each other and far apart; but the peritoneum covered the kidney so as to move with it; the kidney was not simply movable behind the serous membrane.

Treatment.—The treatment of floating kidney must be based on the same principles as that of the treatment of movable kidney. It is only where great suffering, unrelieved by palliative and mechanical measures, is experienced, that any surgical aid beyond the adaptation of a well-made pad and belt would be entertained. Still there are a certain small number of instances in which the mobility of the kidney cannot be restrained by mechanical means, or mechanical means cannot be borne, and the suffering and misery caused are unbearable. In these cases, as was stated in the last chapter, a surgical operation has been performed with benefit.

Now will come in the question, "Is the kidney a 'floating' or a 'movable' one?" in other words, has it a mesonephron or is it entirely shut out behind the peritoneum? A movable kidney, the diagnosis of which is clear, is best removed, as was said above (if removal is requisite), by lumbar nephrectomy. A floating kidney cannot be removed without opening the peritoneum, and therefore the lumbar has not so large an advantage over the abdominal operation as in the case of movable kidney where the peritoneum need not be touched. A floating kidney could only be fixed by nephrorraphy, by perforating the peritoneum, except when the two layers of the mesonephron were very wide apart.

There is, however, no reason why nephrorraphy should not be performed for "floating" kidney under the same conditions as have been mentioned for

"movable" kidney, provided, of course, the kidney can be pushed fully back into the loin, and is not obstructed either by the connections of the mesonephron, by the size of the adjacent solid organs, or by the accumulation of fatty tissue in the loin.

To open the peritoneum at the loin and to bring back the kidney into the wound and stitch it to the parietes is not more dangerous than lumbar colotomy when the peritoneum has to be penetrated. In the latter operation, though interference with the peritoneum is to be deprecated unless actually needful, the mortality is but slightly if at all increased by dragging the colon through an opening in the peritoneum and fixing it by stitches to the edges of the parietal incision.

If nephrectomy is contemplated the lumbar method is the proper operation, provided the diagnosis is certain, and the kidney can be pressed well back into the loin, and the ilio-costal interspace is fairly wide.

If it could be ascertained positively beforehand that the kidney was "floating" and held in check only by a long mesonephron, there would be very little reason for giving the preference to the lumbar operation.

Anything, under these circumstances, which told against the lumbar method would be in favour of the abdominal; because, though the drainage is best with the lumbar incision, the operation is far more easily performed, and the risks of doing harm whilst securing the vessels may be somewhat less by the abdominal method. But the diagnosis between "floating" and "movable" kidney can rarely, if ever, be made; and as, owing to the rarity of a mesonephron, the chances are greatly in favour in any particular instance of there being none, the lumbar nephrectomy is preferable on account of its smaller mortality.

If the abdominal method is selected an incision along the linea semilunaris (Langenbuch's operation) is the best.

LITERARY REFERENCES TO THE SUBJECTS OF THE SECOND, THIRD, AND FOURTH CHAPTERS, BESIDES THOSE MENTIONED IN THE TEXT.

Cruveilhier: "Anat. Patholog.," vol. i., p. 722. 1835
Velpeau: *Gaz. des Hôpitaux*, p. 285; 1853.
Rayer: "Traité des Maladies des Reins," 1841; and *Gazette Médicale de Paris*, No. 51; 1846.
Rokitansky: "Path. Anatomy;" Syd. Soc. Trans., vol. ii., p. 188.
Hare: *Med. Times and Gazette*, Jan. 2, 23, 30, 1858.
Adams: *Med. Times and Gazette*, p. 651; 1857.
Durham: Guy's Hospital Reports, third series, vol. vi.; 1860.
Trousseau's "Clinical Medicine;" New Syd. Society, vol. v., p. 398; 1872.
Gosselin: "Union Médicale," p. 115. 1869.
Fourrier: *Bullet. générale de Thérap.*, 15 Juin, 1875.
Path. Soc. Trans. London: "Report of Committee," vol. xxvii.; 1876.
Langenbuch: *Beilage zum Centralb. für Chir.*, 1881.
Martin: *Centralb. für Chirurgie*, No. 20, p. 44; 1881.
Hahn, Küster, and Esmarch: *Beilage zum Centralb. für Chirurgie*, No. 29; 1882.
Weir, Smith, Polk: *New York Med. Journ.*, 1883.
David Newman: "On Malposition of the Kidney," *Glasgow Med. Journ.* for August, 1883. Dr. Newman gives a very large number of references.
Glasgow Med. Journal for September, 1883, p. 195; October, 1883; November, 1883, p. 329; June, 1884, p. 465, *et seq.*
Landau: "Wanderniere der Frauen, Berlin," 1881.
Lancereaux: Article "Reins," "Dict. Encyclop. des Sciences Médicales," 3rd ser., vol. iii.; 1876.
Roberts, W.: "Urinary and Renal Diseases," 4th ed., 1885.
Dickinson, W. H., vol. iii., 1885.
Jago: *Med. Times and Gazette*, vol. ii., pp. 328—409; 1872
Powell: *Lancet*, 24th June, 1882.
Johnston: *Med. Times and Gazette*, vol. ii., p. 426, 1859; and vol. i., p. 9, 1860.
Flemming: *Brit. Med. Journal*, August 21, 1869.
Watson: Ed. *Med. Journ.*, 1874.
Hunter: Med. Trans. of Lond. Coll. Phys., vol. iii., p. 250; 1875.
John Reid: "Phys., Path., and Anat. Researches," p. 417.

CHAPTER V.

MALFORMATIONS OF THE KIDNEY.

By "malformations" of the kidney is here meant congenital deviations from the natural form and size of that organ.

The kidney becomes changed in outline and dimensions by various diseases. Thus, hydronephrosis, pyo-nephrosis, cystic enlargements, morbid growths, such as sarcoma and cancer of the kidney, tubercle, and the scarred, contracted, and atrophied condition which results from Bright's disease and interstitial nephritis, are all so many forms of "misshapen" kidney. These are described under their several headings. Here we are concerned only with congenital malformations of the kidney.

Till recently such malformations were only physiologically interesting; to-day, owing to the fact that there exists a branch of surgery which is called "the surgery of the kidneys," they are clinically of importance. They are important from this point of view, (1) because malformed kidneys are frequently the result of fusion of both kidneys, and thus there is but one renal organ in the body; (2) because malformed kidneys, even when only one kidney is involved, are generally misplaced; and (3) because when a misplaced kidney is also misshapen, the difficulty in diagnosing the nature of the abdominal tumour which may be formed is greatly increased, and the probability of injurious treatment being adopted is much enhanced. The following case recorded by Mr. Durham in the Guy's Hospital Reports* of 1860 shows the importance of bearing in mind the last statement.

* Third series, vol. vi., p. 407.

A gentleman, aged forty-five, after suffering from a severe attack of fever, noticed for the first time a tumour deeply seated in the hypogastric region, and somewhat to the left of the middle line. This tumour was oval in form, somewhat elastic to the touch, and fixed. It was not nodulated, nor did it possess any distinctive elevations and depressions. Manipulation gave rise to very disagreeable sensations, but not to acute pain. Considerable alarm was felt by the patient, especially as some members of his family had died from "tumour in the abdomen." More than one skilled opinion was taken by the patient, and the conclusion arrived at was that a "tumour of doubtful character" existed in the lower part of the abdomen, for which iodine ointment was to be applied, and iodide of potassium taken internally. This treatment was continued for some time, but of course without effect; the patient never thoroughly recovered his health and strength, and between four and five years after first noticing the tumour he died of pulmonary disease. At a post-mortem examination the tumour was seen to be nothing more than the left kidney misplaced and malformed. The right kidney was normal in form and in its normal position. Both kidneys were healthy in structure and of usual weight. The left kidney had no hilum, and did not possess the characteristic shape. When divested of fat it presented two depressions, one of which extended obliquely across the anterior surface, and the other was on the inner and posterior aspects; thus it was indistinctly divided into three portions. The ureter resulted from the junction of four branches; of these, two came from the upper and posterior part, while the two principal ones came from the anterior and lower part; these branches joined one another about an inch from their several points of exit from the kidney.

There were three arteries, one from the aorta, just above its bifurcation, one from the common iliac artery of the *opposite* side, and one from the internal iliac of the same side. These branches entered different parts of the kidney; the chief supply was derived directly from the aorta. There was one principal vein which passed from the internal and posterior part of the organ into the vena cava, just above the junction of the two common iliac veins. The suprarenal capsule was large, flat, and in its normal position. The kidney was situated over the left sacro-iliac sychondrosis, and extended somewhat on to the promontory of the sacrum, and by its lower part into the true pelvis.

In this instance the kidney was first discovered as a "tumour" after the patient had become emaciated by the fever; and, owing to its abnormal shape, no suspicion of its being a misplaced kidney seems to have arisen; but, as Mr. Durham remarks, "had a correct diagnosis been made, how much alarm and anxiety the patient and his friends might have been spared, and how much irritating and useless treatment might have been avoided!"

Diagnosis.—But the question, "How is error to be avoided, and a correct diagnosis to be made?" remains to be considered. It must be allowed that this is no easy matter, because the abnormality of form deprives us of one of the characteristic aids to diagnosis which fortunately exists in most cases of movable kidney. There is no hilum, perhaps; and if there be, it will almost certainly lack the normal relation to the rounded extremities and the concave and convex borders of the kidney, for neither the rounded extremities nor the natural oblong outline of the kidney may be present. The smooth, firm, but elastic surface of the swelling gives but little information; for a lobulated or deeply grooved kidney

may feel quite smooth and uniform where covered by a thick layer of circumrenal fat, as in Durham's case and others. The misshapen organ may be movable and capable of being pushed back into the loin; but it is far more likely to be fixed as well as misplaced. In this latter case a tympanitic note may be elicited by percussing over the ilio-costal interspace behind, and there may be the loss of the usual resistance in the loin. Neither of these conditions can be depended upon, because the loin region naturally occupied by the kidney is sometimes filled up by a quantity of condensed fatty tissue when the kidney is misplaced. Nor is there anything constant in the characters of the malformation which can be used as a guide. As will be shown directly, there is great variety in the change of shape. There are, however, two signs which should assist the surgeon to a right judgment; these are (1) the peculiar disagreeable, sickly, faint sensation, without acute pain, which is caused by manipulation of the kidney; and (2) the fact that if an abdominal or pelvic tumour is formed by a malformed kidney the tumour is one which does not increase in size. The peculiar sensation, provoked by pressing upon or otherwise manipulating the kidney, is as characteristic in its way as the testicular pain which is caused by manipulating or pressing the testicle. It is a combination of sickening, fainting, and aching sensations; not actual pain, though it may be accompanied by pain along the thigh or over the hypogastrium.

Close and repeated examination of the urine, especially after manipulation of the swelling, or constipation of the bowels, may show some alteration in quantity or composition, or in both; and there may be periods of painful or frequent micturition brought on by muscular efforts, by manipulation of the tumour, or by pressure upon it by hardened and retained

fæces. These, then, are the only diagnostic signs, so far as I am able to gather, of a tumour caused by a malformed kidney.

Form.—As to the shape of the malformed organ, there is vast variety; the commonest amongst those in which the kidney possesses anything like its proper size is no doubt the horse-shoe-shaped fusion of the two kidneys; but there are several other ways in which the two kidneys may be united into one mass, as will be described in the chapter on "solitary kidney." Again, there are the cases in which the malformation is accompanied by great diminution in size, the so-called congenital atrophy of the kidney. This is probably the commonest of all varieties of malformation of the kidney. In such cases there is, of course, no question of diagnosis, because no formation of an abdominal or pelvic tumour; but there is the fear, though it be but a remote one, that such an useless organ may be left behind when nephrectomy has been resorted to for disease of the opposite kidney. I have endeavoured to estimate what this risk really is, by an examination of a vast number of post-mortem records; but to this subject I shall return shortly.

The third class of malformed kidneys is where the two organs are not in any way joined or fused with each other, but one or both of them are malformed. The malformed organ may occupy its natural position, or may be misplaced. An interesting case of malformed and misplaced kidney has been described and figured in chapter ii. It was reported by Mr. Canton. (*See* page 22.)

In this class the commonest variety is lobulation of the organ. Sometimes the lobulation is as marked as in the fœtal kidney. In one case of which I have notes,* this was the condition of both the kidneys of

* Middlesex Hospital Register, vol. 1874; No. 5; Surgical.

an old woman, aged seventy. In another case from the same records (vol. 1881, No. 106), both the kidneys of a man, aged thirty-one, besides being lobulated, were also much flattened, owing probably to the fact that the renal arteries came off from the aorta between two aneurisms, so that doubtless the renal blood supply had been much disturbed. This was a combination of congenital and acquired abnormality of form. In a third case (1881 vol., No. 211) both kidneys of a woman, aged fifty-five, were much lobulated, and a deep transverse fissure divided the anterior surface of the left. In these cases, and in others of marked congenital lobulation of which I have the notes, the kidneys were in their natural position. In a fourth (vol. 1879, No. 110) case the left kidney was misplaced and malformed, having a trilobate shape, with three arteries derived from different parts of the aorta. Its hilum was in front, and its ureter came off from its anterior surface. Its posterior surface was marked by a sulcus, in which the common iliac artery rested. This kidney was situated upon the left common iliac vessels. The patient was a lad, aged nineteen, who died of chronic Bright's disease. In another instance (vol. 1879, No. 77), in a woman who died of carcinoma of the right side of the chest, the right kidney was granular and contracted and "curiously deformed." It was very small, and almost completely divided into two equal parts by a deep constriction. The left kidney was twice the size of the right. In another (vol. 1874, No. 1) both kidneys of a woman, aged forty-five, were found malformed, the right being quadrate in shape, and the left prismatic; they were in their proper situations, and their structure was healthy.

In a case, the notes of which I have derived from the records of Guy's Hospital (vol. 1880, No. 402) both kidneys of a woman, aged thirty-five (who died of

suppurative perimetritis and endocarditis), were found malformed, and the right one was misplaced as well. The *right* kidney lay upon the psoas muscle at the brim of the pelvis, and as it were upon its back, its shape being "altered and difficult to recognise." The hilum was on the anterior surface, and out of the hilum passed the pelvis, the ureter taking an oblique

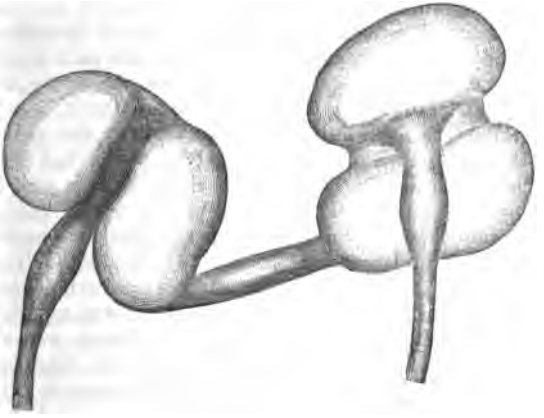


Fig. 6.—Two Malformed Kidneys joined by a transverse Band of fibrous Tissue. (Diagrammatic.)

direction across the kidney from above downwards and outwards. The *left* kidney was in its proper position, but lying like the right, as it were upon its back, with its pelvis emerging from the anteriorly aspect, and its ureter passing across the anterior surface. The hilum of each kidney formed part of a deep fissure, which cut the organ almost into two, so that the appearance suggested to some was that there were four kidneys. Each organ had, however, but a single pelvis and ureter (Fig. 6). Another remarkable condition

about these oddly shaped kidneys was a tough white tendinous band running from one to the other at their lower part. This band was part and parcel of the capsules of the two kidneys, and represented the isthmus which lies across the spine in the common form of horse-shoe kidney.

The right kidney had two arteries derived from the aorta and entering the fissure on the front surface of the organ. The left kidney had three arteries, two of which entered the under surface of the lower part of the organ, the other ran with the vein to the hilum on the front. One of the two vessels to the lower part came from the common iliac artery.

Sometimes the only malformation is at the pelvis of the kidney. Thus, a man, aged forty-six, died from hernia reduced *en masse;* his right kidney was of elongated shape, and had two pelves which united into one ureter. The testicle, of the same side as the hernia, was undescended (Guy's, 1877, No. 309). Two somewhat similar cases are recorded in the Pathological Transactions, of London.* One of them was reported by Sir Henry Thompson. Only one kidney was affected. It came from a man, aged ninety-six, who died after an impacted fracture of the neck of the femur. The kidney was rather under than over the natural size, but it gave a slight indication of having a natural division into an upper and lower portion. Two pelves were attached, the cavities of which did not communicate with one another. Of these, the lower was very much the larger, and formed a trumpet-shaped sac; the dilatation apparently resulted from a narrowing of the ureter just below. The upper pelvis, small and tubular, became of natural size at a distance of three and a half inches from its hilum; and an inch below this point, *i.e.* four and a half inches from the kidney, both ureters joined to form a single tube of the

* Vol. vi., p. 264, case 23; and vol. xxxi., p. 188.

normal size, which entered the bladder at the usual spot.

In the other case, Dr. W. Ewart informs us that both kidneys were furnished with two distinct pelves and ureters which ended separately in the bladder. All four ureters were pervious, a condition which would have sorely tried the skill of the ingenious inventors of instruments for catheterising and compressing the ureters for diagnostic purposes. Each kidney presented faint indications of having been double; each was larger than normal, and consisted of an upper and a lower portion which were continuous. In both kidneys the ureter of the lower portion was uniformly dilated and much ulcerated, and the corresponding portion of the gland was a sacculated cyst nearly devoid of any secreting tissue. The upper part was in an earlier stage of tubercular disease; the upper ureters were normal. The bladder and prostate were tubercular and ulcerated. The patient was a man, aged forty-five, who died of phthisis and tubercular disease of the urinary organs.

A third case of double ureter to the right kidney was recorded in 1861, in the twelfth volume of the Pathological Transactions, by Mr. Durham (p. 135, case 5). There was no distinct hilum, but the blood-vessels and ureters were connected with the anterior and lower part of the kidney; whether two ureters joined or entered the bladder separately, the report does not say. The right kidney weighed but two and a half ounces, was healthy in structure, and was curiously misplaced, being situated altogether above the level of the last rib and was firmly connected with the diaphragm by dense fibrous tissue. It was supposed that this misplacement was due to perinephritis occurring at a very early period of life, if not during intra-uterine existence. The left kidney was double its usual size, healthy in structure and normal in situation.

A fourth case was reported by Mr. John Wood.* In this the left kidney had two ureters issuing respectively from the upper and lower end of the pelvis of the kidney; they were rather less than the normal size, and united about one inch from the bladder, into which they entered as one tube in the usual situation. The pelvis of this kidney was represented by two distinct mucous cavities, each of which was continued into its corresponding division of the ureter. This condition is a link between the ordinary state and the instances of two separate pelves. In the right kidney of the same subject (a girl, aged ten) there were two separate pelves and ureters; the upper one, communicating with a sacculated or cystic part of the kidney, opened separately into the bladder by the side of the uvula vesicæ, close to the exit of the urethra. This case will be referred to again in the chapter on hydro-nephrosis. Mr. Sutton tells me that in three years he has met with twenty cases of double renal pelvis in the post-mortem and dissecting rooms; the duplicity varied in length from half an inch to two inches or more.

In some instances the absence of a hilum seems to have been the chief deformity. Newman gives a case in which the right kidney was situated half an inch to the right of the promontory of the sacrum, and the left in the iliac fossa. The right kidney was small and so altered in form that there was no hilum, and the ureter passed from the lower aspect of the organ. The tissue of the organ was normal. The arteries, two in number, came off from the aorta an inch above its bifurcation. The left kidney was normal in every respect except as to its situation.

In some others the deformity seems to have depended upon the structures immediately in contact with the misplaced organ, especially the blood-vessels.

* Path. Soc. Trans., vol. vii., p. 261, case 12.

I have mentioned above one case in which the posterior surface of a kidney was deeply grooved by the common iliac artery. M. Aubé reported a case of left kidney misplaced between the common iliac arteries, and flattened, having its anterior surface divided into three parts by two depressions formed by the passage of two arteries. Other similar cases might be quoted.

Lastly, a peculiarity of some importance was in 1866 described by Dr. Hilton Fagge,* from a dissecting-room subject. The ureter lay in front of the renal artery and vein at the hilum, not behind them. It shows, more especially as the usual flattening of the posterior surface was also absent, that it is not possible to say with absolute certainty from the relative position of the ureter and blood-vessels, whether a kidney, after its removal from the body, is a right or left one. Fagge had not found mention in any work on anatomy that the ureter is liable to this change of position. It must be exceedingly rare.

As some slight guide to the relative frequency of the various forms of malformation, the following analysis of ten years' post-mortem examination at two London hospitals is appended.

At Guy's Hospital, out of the total number of cases, namely, 4,632, there were fourteen instances of misplaced or malformed kidneys. Of these fourteen cases:

7 were misplaced, including two slightly movable.
1 was very movable.
5 were horse-shoe-shaped.
3 were malformed. Of these three, one was a fused and misplaced renal mass; in another, both kidneys were malformed and the right one was misplaced as well; the third was simply malformed, being elongated in shape and having two ureters. The details of two of these cases have been given above; those of the case of fusion will be given farther on.

* Path. Soc. Trans., vol. xvii., p. 171.

At the Middlesex Hospital, out of the total number of post-mortem examinations, namely, 2,610, there were nineteen cases of malformation. Of these nineteen cases:

9 were lobulated; in four cases both kidneys, in five only one organ being thus affected.
6 were congenitally atrophied as to one kidney
4 were atrophied from disease.
1 was horse-shoe shaped.
4 were malformed, but not fused.

There was no case of movable kidney and none of double pelvis or ureter recorded. A double renal pelvis is, however, so common that it is now probably rarely deemed worthy of record.

In one of the cases the same kidney (right) was congenitally lobulated and atrophied. In another both kidneys were lobulated, and the left one had a *deep transverse fissure across its front surface.* In another the left kidney was lobulated, *misplaced,* and *trilobate.* In another an atrophied kidney was almost *divided into two parts.* In another case one kidney was *quadrate* and the other *prismatic.*

It will be noticed in the above analysis of the Middlesex Hospital cases that there were six cases of congenital atrophy of one kidney. This is not to be read as six cases of absolute congenital deficiency of one kidney. On the contrary, there was not one such case amongst them. The smallest of them seems to have weighed one and a half ounces. Of the four cases of atrophy from disease, in one the kidney substance was "entirely atrophied," and in another "the kidney was so small and atrophied that scarcely any renal tissue was left, and there was no obstruction in the ureter."

In the Guy's analysis, as given above, there is no account of the atrophied organs; but the total number of cases in which there were "atrophied," "wasted,"

and "shrunken" kidneys was 47. Not one of these, however, was an instance of total non-development or congenital deficiency; but all cases of small kidneys in Bright's disease, and after interstitial nephritis, are included in this number.

CHAPTER VI.

ABSENCE OF ONE KIDNEY—SINGLE KIDNEY.

To the surgeon of the present day the absence of a kidney is a subject of vast importance, and one which must be duly taken into account when nephrectomy is contemplated. Though there are certain conditions in which it is less than usually improbable (I will not say more than usually probable) that only one kidney exists (as, for example, when some congenital deformity or abnormality, more particularly of the genital organs, is present), there are, on the other hand, cases in which the surgeon may be sure that his patient is possessed of both kidneys. In some instances of hydro-nephrosis and in some calculous cases the complete plugging of one ureter is known to have occurred by the alteration in the symptoms during the course of the disease, and yet in despite of the occlusion urine continues to be excreted. The urine in such case must come from a second kidney. Still there are cases in which less definite evidence is obtainable, and then it is important to know the average probability of only one kidney being present. I shall endeavour now to answer this question.

But first let us enquire what is understood by single kidney. Morgagni* divided the cases of one

* Letter xlviii., art. 16.

kidney into two classes, namely, those in which one kidney was made up of two, and the other where one kidney only had been formed. These latter he again subdivided into those in which the single kidney occupies the loin as usual, and those in which it is misplaced on to the spine or into some central position. In Morgagni's day (1769) several cases of each class had been collected and they have been since made use of by later writers, especially by Rayer. The term "solitary kidney" had frequently been used as a general name for all cases in which there was only one renal organ; but Rokitansky limited this name "solitary kidney" to the renal mass which consists of the fusion of the two kidneys; and he employed the name "unsymmetrical kidney" in cases in which one kidney only is present, and its fellow is altogether deficient. Rokitansky's definition of an "unsymmetrical kidney" was, a kidney which "is normal in position and conformation, and occasionally rather enlarged, its fellow being deficient." Exception must, however, be taken to this definition, because the existing kidney may be abnormal either in conformation or position. In a case dissected by my friend Mr. Sutton, the only existing kidney was a mere congeries of cysts, and was found in the body of a fœtus born at full time. This case is a connecting link between absence of one and of both kidneys. In another case* in which the absence of one kidney led to a disastrous result after nephrectomy, the only existing kidney occupied the left iliac region.

There is a real distinction between the two classes described by Morgagni and Rokitansky, and named by the latter "solitary" and "unsymmetrical." But a third class of single kidney must be added to these two, namely, the "atrophied kidney;" for in not a

* *New York Med. Journal*, Feb. 17, 1883; Dr. W. Polk.

few individuals one kidney is so little developed or so completely destroyed that there is practically but one kidney present. To the surgeon who is contemplating nephrectomy there is no practical difference betwixt congenital absence, extreme congenital atrophy, or rudimentary development of one kidney, and total destruction of one by disease. There are, then, at least three varieties of single kidney, two of them being forms of deficiency of one kidney, and the third a fusion of the two kidneys into one mass.

A. Unsymmetrical kidney, *i.e.* entire absence of one kidney.

B. Atrophy; including congenital rudimentary kidney, or, in other words, congenital atrophy.

C. Solitary kidney, *i.e.* fusion of the two kidneys into one mass. This class includes the horse-shoe kidney.

Now it would seem that quite a host of examples of congenital absence of one kidney in man as well as in the lower animals have been met with; and the first impression made by reading of the numbers of recorded cases is that single kidney must be quite a common event. Morgagni refers to many. Rayer has collected no less than from forty-five to fifty cases, Mosler twelve, Roberts of Manchester refers to five others, and Mr. Sutton has given me the notes of four cases dissected by himself. If, however, the cases referred to by Rayer are carefully investigated, it is disappointing to find how few of them are satisfactorily reported. When, too, it is borne in mind that such cases are pretty nearly sure of being published, or recorded, in some way or other; that Rayer's investigations extended over a good part of the literature of a century and included the results of researches which went back to very early times; that most of the cases quoted by him had been enumerated by Morgagni and other previous writers and were not derived

from his own experience or observation; and, lastly, that we have no record as to the proportion which these cases bore to the total number of subjects examined by those who reported them, it is obvious that we cannot draw any conclusion whatever from them as to the frequency of the congenital absence of one kidney.

I have made a careful examination of the descriptions of forty-six cases of single kidney derived from sources quoted by Rayer. Of these, two were horse-shoe-shaped; in six the two kidneys were fused and the renal mass occupied the median line; in four others the two kidneys were probably fused, and the renal mass was situated on one side or other of the spinal column. (In one of these the renal mass was on the right side of the spine, and had two pelves and two ureters, both of which joined the right side of the bladder: Morgagni mentions this case as one of unsymmetrical kidney, and not as resulting from fusion.) In six cases there was complete atrophy of one kidney, the result either of defective development or disease; eleven were cases of too doubtful a nature to classify; seventeen cases were unsymmetrical kidney. In twelve of these seventeen the corresponding ureter was absent; in ten of them it is distinctly stated that there was no trace of the ureter, or words to that effect; in the other two it is mentioned that there was no ureteral orifice in the bladder on the side of the absent kidney. In the other five the ureter may be assumed to have been absent because no mention of one is made.

In nine of the seventeen cases here included under "unsymmetrical" kidney a doubt might be felt as to whether they were not really fused or solitary kidneys; in four of them it is stated that the renal mass was "double size," "very large," or much larger than an ordinary kidney, but in none of the nine are any particulars given as to the ureter or ureters.

Twenty-two of the cases tabulated were in *adults.*

Ten occurred in women, ten in men, and in three the sex is unstated.

Four were in *young persons* between four and fifteen years old; three girls, and one boy aged four years.

Two were in *fœtuses.*

One was in a *fœtal monster.*

Seventeen cases are so recorded as to afford no information as to either age or sex.

Of these forty-six cases, in only eight is the single kidney stated to have been misplaced, namely, the two horse-shoe-shaped, and the other six fused renal masses. These all occupied a position in the median line. In the other cases it is either stated or implied that the existing kidney was in one or other loin.

The forty-six cases show the various ways in which there may exist only one renal mass, and give a fair idea of the proportion the various forms bear to one another; but they do not in the least assist in answering the question, "How often, or in what percentage of cases, may we expect to find a single kidney?" Only the examination of a great number of post-mortem records can furnish the answer. I have attempted this with the following results.

At Guy's Hospital in the ten years ending 1882, 4,632 post-mortem inspections were made, and only one case of congenital absence, or undeveloped rudiment, of one kidney was found. This was in a man, aged forty.

At the Middlesex Hospital in the ten years ending 1883, 2,610 inspections yielded no case of congenital absence, or undeveloped rudiment, of one kidney.

At St. Bartholomew's in the ten years ending 1884, 3,800 medical post-mortems yielded no case of congenital absence, or undeveloped rudiment, of one kidney.

At the Hospital for Sick Children, Great Ormond

street, in the ten years ending December, 1884, the total number of post-mortem examinations was 936, and amongst them was *one* case of congenital absence of one kidney, and *one* of extremely defective development. The former occurred in a male, aged five years and four months. The left kidney alone was present. It weighed four and three-quarter ounces, which is about the weight of two normal kidneys of a child of five and a half years old. The pelvis and ureter were proportionately large. The organ appeared to be quite healthy. There was no trace of a right kidney or ureter, and no indication whatever of an ureteral orifice on the right side of the bladder.

The case of extreme congenital atrophy of one kidney occurred in a new-born male with imperforate rectum who lived only five days. The right kidney measured one inch and its pelvis was much dilated; the left kidney measured only one-third of an inch, and was smaller than a haricot bean.

By adding these figures together we have a total of 11,978 post-mortem examinations, yielding three cases of absence or extreme atrophy of one kidney; so that it would seem that the proportion of cases in which congenital absence of one kidney is to be looked for is once in every 3,992⅔ cases.

And that this estimate is not far from being correct I am the more persuaded by the statements, apparently very wide of one another, of Dr. Robert F. Weir, of New York, and Dr. O. Petersen. Dr. Weir* states that "the single kidney is found about once in five thousand bodies," and Dr. Petersen † says that only once was the kidney (the left) wanting in 1,500 post-mortem examinations of his own. By adding Dr. Weir's and Petersen's cases together we get two cases

* *New York Med. Journ.*, Dec. 27, 1884. Dr. Weir does not give the data of his estimate.

† *Med. Times and Gazette*, Oct. 7, 1882.

of absence of one kidney in 6,500 bodies examined, *i.e.* one in 3,250, a proportion somewhat higher than that in the London cases.

The figures which I have obtained from the four London hospitals and given above may be taken as representing the proportion of cases of unsymmetrical kidney, and of extreme congenital atrophy or defective development. They do not, however, represent the proportion of cases of horse-shoe kidney and other forms of fused kidneys, nor of kidneys atrophied by disease; nor those congenitally small or atrophied kidneys which weigh from an ounce or an ounce and a half upwards, and possess some though not a full amount of glandular substance.

I have referred in some detail to these deficiencies under the chapters on malformed, atrophied, and horse-shoe kidney; but for readiness of comparison the following figures may be repeated. Nine horse-shoe kidneys were found in 14,318 examinations, *i.e.* one for every 1,600 (about). One fused kidney (other than horse-shoe-shaped) occurred in 8,178* inspections; 59 "atrophied," "small," "shrunken" or "wasted" kidneys in 8,178 inspections. This last number is in addition to the one case of mere rudimentary kidney included above in the three cases of absent kidney.

The result of this investigation points, then, to the following conclusions: (1) The probability of a person having only one kidney owing to congenital absence or non-development of the other, is *excessively small.* (2) That there is a much larger risk of meeting with a horse-shoe-shaped, or otherwise fused, renal mass; and a very much greater risk still of finding one of the kidneys wasted or atrophied by disease. (3) That as the fused kidneys are generally situated in the

* The 8,178 are from Guy's, Middlesex, and Children's Hospital. In the Bartholomew's Hospital cases no mention is made of such a case; if these be added, then one in 11,978.

median line of the body, their position would be sufficiently suggestive to prevent error.

In cases of a kidney wasted or atrophied by disease, the clinical history and characters of the urine would generally afford a guide and warning; but despite all care there must sometimes be a risk in nephrectomy, whether abdominal or lumbar, of leaving behind no vestige of sound kidney tissue, if the operation is resorted to for certain classes of cases. These cases are, most especially, tuberculous disease, and calculous pyelitis when there are grounds for thinking that both kidneys have been afflicted at some time or other.

Congenitally small kidneys are often healthy in structure; but it is doubtful at present how long life could be sustained with only one ounce, or one and a half ounces, of healthy renal substance. We know that we are endowed with at least twice the quantity of renal tissue necessary for active vigorous life, but we do not know the minimum amount which is requisite for comfortable and active existence. (*See* case by Eustachius, mentioned on page 81.)

CHAPTER VII.

"UNSYMMETRICAL" KIDNEY.

This is the true type of congenital absence of one kidney. There is one normal, or at least functionally normal, kidney, and its fellow is altogether deficient. The corresponding suprarenal capsule is wanting in about one out of every ten cases of congenital absence of the kidney.

Situation.—The existing kidney may be situated either in its natural position, or may be misplaced on to the spine or in some other direction. Meckel has stated that when the kidney is situated in the pelvis it retains

its lobulated and fœtal appearance throughout life. This is not borne out by all the cases. In Polk's case,* a young woman, æt. nineteen, had but one kidney, which was misplaced, and occupied the left iliac fossa. It was fixed between the crest of the ilium and the brim of the pelvis, and was covered over its front surface by peritoneum. The left ovary lay directly upon the kidney. The ureter pursued its normal course in the pelvis to the bladder, and was about twice the natural size. There was no trace of a second ureter to this kidney, nor of a right kidney or right ureter. The kidney was quite normal in structure, and smooth on the surface.

So with kidneys lying on the sacrum. There are instances in which it is very difficult to say whether the existing renal organ is an "unsymmetrical" or a "solitary" kidney, by "solitary" being meant a fusion of the two organs in which the fusion is complete. Neither the size of the renal mass, nor the number of the ureters, nor the manner in which the ureter opens into the bladder, can alone settle the doubt.

Size.—It has been stated many times that when there is only one kidney it always exceeds the natural size. But this is not correct. An unsymmetrical kidney, like a renal mass composed of two kidneys closely fused together, may be either of much greater magnitude than the normal kidney, or not at all in excess of the normal.

Number of ureters in "unsymmetrical" and "solitary" kidney.—As to the ureters, it is most frequent in fused kidneys to find two pelves and two ureters, which pass down to the bladder, there to enter in the usual manner; but, on the one hand, in some clear instances of fusion of two kidneys there has been only one ureter, which has entered the bladder in the mesian line: and, on the other, there are instances

* *New York Medical Journal*, February, 1883.

where two kidneys were present, one of which had two separate ureters which either united before reaching the bladder, or entered separately into the same side of the bladder; whilst the ureter of the opposite kidney entered as usual on its own side of the bladder.

When a single kidney, whether of ordinary size or of much greater dimensions, has a single ureter entering the corresponding side of the bladder, there can be no doubt of its "unsymmetrical" character. When a renal mass with faint or marked traces of separation into two masses, has two ureters, which enter in the usual situations, one on each side of the bladder, there can equally be no doubt of the "solitary" mass being the result of the fusion of two kidneys. But between these types there may be all degrees and variations; and a difference of opinion as to the congenital absence of one kidney, or the congenital fusion of the two, may therefore very possibly arise.

Morgagni describes the case of a woman who died of dysentery, and whose body was dissected by Valsalva; the left kidney was altogether deficient, but the deficiency was supplied by the right kidney, which was twice as large as natural, and was furnished with a double pelvis and ureter. *Both the ureters went to the right side of the bladder.*

Morgagni also mentions the cases of Panarolus and Laubius (also referred to by Rayer) as instances in which one kidney only was formed, and was lying on one side of the spinal column as usual, *i.e.* like an ordinary "unsymmetrical" kidney; but he adds that there were two pelves and two ureters, and that one of the ureters inserted itself into that part of the bladder to which no kidney corresponded, thus differing from the arrangement met with in the woman dissected by Valsalva.

It would thus seem that in these two cases (of Panarolus and Laubius) the condition was more like

fusion of the kidneys, in which the "solitary" organ was lying on one side of the spine, than "unsymmetrical" kidney. Morgagni, however, includes them in the class which Rokitansky has named "unsymmetrical."

Morgagni refers to no less than nineteen other cases, which he classes under the same heading; but many of them are merely described by their reporters as instances of "one kidney only"; and Morgagni considered that in some of these examples the one kidney mass seemed to be made up of the two kidneys.

But setting aside all doubtful cases, there are a number of instances of unsymmetrical kidney occupying its **natural position in the loin.** To quote Morgagni again, he describes the case mentioned by Valsalva and Rayer, of a priest, aged sixty, who for thirty years was subject to thirst and sudden faintness, and died at last of fever. One kidney was wanting, and there was no trace of the emulgent vessels of that side. The other kidney was of natural size, and contained "hydatids."

In another instance (Hilscherus) the patient suffered from renal ischuria from calculi. The kidney was not misplaced.

Dr. Duckworth * recorded the case of a woman whose right kidney occupied the right loin, but there was no left kidney or ureter. The right organ greatly enlarged, weighing nine ounces, and measuring five inches in width at its central part, possessed one ureter, which passed to the right side of the fundus of the bladder, which it entered as usual.

Dr. Greenfield's second case† is one in which there was entire absence of the right kidney, renal vessels, and ureter, together with the testis, vas deferens, and vesicula seminalis on the same side. The subject was

* Path. Soc. Trans., vol. xx., p. 232.
† Ibid., vol. xxviii., p. 164.

a male, aged fifty-nine, who died of extravasation of urine and urinary fistulæ. The left kidney was slightly enlarged, but not misplaced.

In a case contained in Guy's Post-mortem Records the left kidney of a woman, aged forty, was entirely wanting, as was also the left renal artery. The right kidney was converted into a large sacculated cyst of about double the size of the natural kidney, and having only a thin layer (barely two millimeters) of kidney tissue in its walls. The sac was full of ropy pus and coagulum; and the ureter was dilated to the size of the little finger, its lining membrane being thick and warty. The cause of the pyo-nephrosis, for such it was, proved to be stricture of the urethra and contracted thickened bladder. Dr. P. W. Macdonald * relates a case of absence of right kidney and ureter in a female epileptic maniac, who died of phthisis. The left kidney was in its normal place, and had a single ureter of ordinary size which opened into the bladder on the left side. The kidney weighed nine ounces.

Dr. Turbin,† of Tiflis, has recorded an example of congenital absence of the left kidney in a prisoner, sixty years old. The ureter on the same side was absent. At the site of its termination in the bladder there was a diverticulum a few centimeters long. The size of the existing kidney is not given. Dr. Turbin had collected eight cases from literature; five times the left kidney was wanting, three times the right. To this, O. Petersen, from whose abstract in the *Deutsche Medicinal Zeitung* this report is taken, says that only once the left kidney was wanting in 1,500 post-mortem examinations of his own.

Mr. Sutton has given me notes of two cases of congenital absence of one kidney, *i.e.* "unsymmetrical" kidney. One was a well-formed fœtus born at full time.

* *Lancet*, May 30, 1885.

† *Am. Journ. Med. Sciences*, Jan. 1883; p. 239.

The right kidney only was present, and was twice its natural size; the ureter was much dilated. There was no trace of the left kidney, ureter, or vessels. The second case was also a fœtus, born at full time, and the right kidney only was present. There was no trace of the left kidney, ureter, or vessels. The existing kidney was simply a congeries of cysts.

Other similar cases in which the organ was not misplaced might be quoted. Several such are included amongst Rayer's cases.

Mr. Gubbin* exhibited to the Sheffield Medico-Chirurgical Society a right kidney, weighing thirteen ounces, but otherwise normal, taken from a man, aged 24, who died of hæmatemesis. The left kidney, ureter, and suprarenal capsule were entirely absent, and the left lobe of the liver weighed only a few drachms. Mr. Sutton tells me he has met with instances of single kidney in two sheep, one horse, and a common hen, and that in each case the existing kidney was twice the usual size.

Instances of an unsymmetrical kidney occupying **an abnormal position,** resting upon the lumbar vertebræ, the promontory of the sacrum, or sacral bodies, are less frequent than those which are situated in the loin.

Dr. M. Watson, in an interesting paper in the *Edinburgh Medical Journal*,† has recorded a case in which the right kidney, as well as its ureter, were absent entirely, and there was no trace of the entrance of an ureter into the bladder of that side, the mucous membrane being quite smooth. The left kidney, which was not larger than usual, was circular in form and lobulated on the surface (thus corroborating Meckel),‡ and was situated close to the

* *Brit. Med. Journal*, Jan. 20, 1883.
† July, 1874, p. 13.
‡ *See* page 71, *supra.*

brim of the pelvis, in front of the common and external iliac arteries of that side. The left ureter was much dilated at the hilum, and nearly double the normal size, except at the point of entrance into the bladder, where it was quite natural. This unusual position of the kidney had forced the distended bladder towards the opposite side of the pelvis. The artery to this kidney came off from the fork of the aorta, and entered the upper end of the kidney after dividing into two trunk branches.

CHAPTER VIII.

ATROPHY OF ONE KIDNEY.

Atrophy of the kidney may be either congenital, or the consequence of disease.

Diagnosis between congenital absence and atrophy.—Congenital absence of one kidney must not, physiologically, perhaps, be confounded with congenital atrophy, or, more properly speaking, rudimentary development of one kidney. Clinically, and to the surgeon who is contemplating nephrectomy, they are practically the same thing. Even physiologically it is sometimes difficult to say whether there is congenital absence, or congenital atrophy. For instance, Ebstein tells us that he found, in a man, aged twenty-four, whose left kidney was greatly hypertrophied, "a pale reddish mass of connective tissue, surrounded by considerable adipose tissue," at the upper end of the right ureter. "This mass was smaller than the normal suprarenal gland; no glomeruli and no uriniferous tubules could be discovered in it;" yet a very narrow ureter and pelvis of ureter, as well as a very small representative of

the renal artery, were connected with this mass. Ought this to be considered a specimen of atrophied kidney, or of congenital absence of the kidney with the pelvis and ureter of that side imperfectly developed? Ebstein speaks of it as an instance of congenital atrophy, and this opinion is probably the right one.

Morgagni agreed with the doctrine of Aristotle, which is that the kidney has been congenitally *absent* in cases in which no vestige of either emulgent vessels or ureter or kidney exists, as was the case in a little girl dissected by Poupart, and in the priest and the woman dissected by Valsalva; and he formed the same conclusion regarding cases in which, though some trace of ureter or emulgent vessels is present, there is evidence in the great size and double pelvis and ureter of the existing kidney to show that it was Nature's intention from the beginning that the functions of two kidneys should be discharged by a solitary renal mass. He further considered that there is evidence of congenital *absence* of kidney, even though neither ureter nor emulgent vessels were wanting, when nothing but fat occupies the renal region. He found such a condition in a healthy whelp which he dissected in Bologna in 1702. The ureter, though joined with the bladder, was but a solid cord ending above in slender striæ, just before it reached the fat; and the emulgent artery, much smaller than natural, ended in small ramifications which only crept through the fatty tissue above described.

In a large majority of cases in which one kidney is absent we find the ureter absent too, but when a rudimentary kidney is present, no matter how rudimentary the minute mass may be, either the upper or lower end, if not the whole, of the ureter is generally more or less developed.

This accords with Valentine's teaching, "that the ureter, the pelvis of the kidney, and the uriniferous tubules are formed in a general blastema, independently of one another."

It is proved by the descriptions of recorded cases. I have put into a tabular form all the cases (1) of atrophy of one kidney; (2) of unsymmetrical kidney, which have been recorded in the Pathological Transactions of London; there are four instances of atrophy, in all of which the corresponding ureter was more or less developed; there are five instances of congenital absence of one kidney, and in only one of them was the ureter present; in the others there was no trace whatever of an ureter, and in two it is stated that even the ridge bounding the trigone of the bladder, and on which the ureter normally opens, was wanting. In twelve out of seventeen "unsymmetrical" kidneys in Rayer's list the corresponding ureter was absent. (*See* analysis of Rayer's cases given in chap. vi., page 66 *supra*.)

Dr. M. Watson * gives the post-mortem notes of a man who was the subject of epileptic attacks. The left kidney was larger than usual, and weighed nine and a half ounces, whilst the right was reduced to the size of a large bean, measuring an inch and a half by one inch. It was situated in its usual position, and presented to the naked eye on section no trace of any subdivision into cortical and medullary substance. Microscopically it was composed of fibrous tissue, with here and there isolated tubes much larger than the ordinary renal tubules; these tubes were filled with cells and connected with what appeared to be well developed Malpighian capsules. The persistence of the tubules and Malpighian capsules is the more noticeable because there had never existed any outlet for their

* *Edinburgh Medical Journal*, July, 1874; p. 15.

secretion. The ureter had no connection whatever with this rudimentary kidney; though pervious at the bladder, it degenerated into a fibrous cord in the neighbourhood of the kidney, and was lost in the loose and subperitoneal connective tissue before reaching the atrophied organ.

Is atrophy congenital, or induced by disease?—The pathologist may sometimes have difficulty in determining whether one kidney was originally atrophied, or had been destroyed by disease. Morgagni * knew that the kidney is sometimes so contracted by disease as to make good pathologists think that the organ was originally deficient. In support of this statement he refers to three cases described in the Sepulchretum. In one, the case of a girl, though there was nothing in the place of the kidney, there was an ureter going down to the bladder from the side of the vena cava, to which it seemed to have become agglutinated, after the kidney was consumed.† In another, that of a woman, instead of a right kidney there was seen "a certain kind of involucrum," a membrane which Morgagni supposed often remains behind when the kidney has been destroyed, and which has been described as a "purse" or "bag" by many observers.

The causes of secondary atrophy of the kidney, or, in other words, atrophy due to disease, are numerous, but chronic Bright's disease is by far the commonest. Rarely, as the result of wasting from Bright's disease, the two kidneys of an adult will weigh together less than one and a half or two ounces, and often less than three ounces.

* Morgagni, lib. xi., art. 14.

† This is probably the same case that Blasius gives; the subject was aged twenty-four, and the left kidney was wanting. The left ureter was a fibrous cord without lumen, and a mass of white solid matter as large as two walnuts was attached to the vena cava.

Wasting of the kidney is not an infrequent result of obstruction of the ureter, as will be described under hydro-nephrosis; and in cases of obstruction of the urine from stricture of the urethra or stone in the bladder, localised wasting of the kidney, the result of previous interstitial nephritis, is by no means uncommon. In these latter cases the surface of the kidney is fissured, and the whole organ more or less shrivelled and atrophic, and bands or areas of fibrous or scar tissue are to be seen in its substance. Embolism, again, leads to a very similar scarred and atrophic condition.

The kind of atrophy which, however, is most likely to lead to surgical difficulties and catastrophes is the congenital.

In the secondary forms of atrophic kidney, the clinical history, the age, and the state of the urinary secretions and passages of the patient, are pretty sure to lead one to a correct diagnosis as to the state of the kidneys. But in congenital atrophy even the most careful may be betrayed into error. It occurs independently of intrarenal compression, of interstitial nephritis, or of embolism; and is due to some defect of development, and often is dependent on the rudimentary size of the renal artery.

The rudimentary kidney varies widely; sometimes it is fœtal in size, and lobulated; sometimes it is represented by a small group of vesicles, sometimes by a small mass of fibrous or fatty, or fibro-fatty tissue, sometimes by a mass of white solid substance attached to the vena cava, and sometimes it is cystic, with patches of secreting substances on the cyst. Wilks and Moxon met with a case in a young man aged twenty-three, who died of chronic albuminuria, in whom there were but two pyramids in each kidney, the kidneys themselves being very small, owing to deficient development. Other defective and peculiar

conditions noticed by Ebstein and Watson have been mentioned above.

The ureter of the congenitally atrophic kidney varies much.—Sometimes it is a fibrous cord without a lumen (Blasius); sometimes it is twisted on itself, ending in a reduplication, and thus having no communication with the bladder; sometimes it is short and narrow, and has an opening into the bladder no larger than a pin hole; sometimes it is of normal size and appearance, and passes down from the atrophied kidney to open quite naturally into the bladder.

All kinds of variations as regards the renal vessels of the atrophic organ have been described. The atrophic kidney may be also misplaced, as in Dr. Ewart's case.*

It is more than probable that congenital atrophy or deficiency of one kidney predisposes to chronic renal disease, and to albuminuria in early and young life. Eustachius found in the body of Bonifacio Corneo one kidney the size of a chestnut, and sound; but the other large and in a state of suppuration from calculous pyelo-nephritis. He thought that the stimulus of disease had drawn blood from the healthy to the calculous kidney, and hence the shrinking of the healthy organ. But it is much more probable that the small healthy kidney was atrophic from birth, and that its vessels were originally small in proportion. The case is of importance, because it shows with how small an amount of functionally active renal tissue life can be sustained.

The frequency, or rather infrequency, of congenital atrophy of one kidney, where the atrophied organ is for all practical purposes quite wanting, may be judged of by the fact that there are only four such examples recorded in the whole thirty-five volumes of the Pathological Transactions of London; and from the

* *See* Path. Soc. Trans., vol. xxxi., p. 187.

following figures: 11,978 post-mortem examinations at St. Bartholomew's, Guy's, the Middlesex, and the Hospital for Sick Children, Great Ormond street, give only ONE case of extreme atrophy or extreme want of development of one kidney.

The figures of the Middlesex and Ormond street hospitals show that *the disproportion in size* of the two kidneys from some amount of, but not extreme, congenital atrophy of one of them, occurred nine times in 3,546 subjects. In all but one of these cases the opposite kidney was much enlarged, so that there was quite an average normal amount of renal tissue contained unequally in the two organs. In the one case in which this was not so (a child aged two and a half years), one kidney weighed two ounces and the other three-quarters of an ounce.

The Middlesex Hospital figures show that in four cases in 2,610 there was disproportion in size, owing to atrophy of one kidney from disease; the other kidney in each instance being very much enlarged.

The Guy's cases show forty-seven instances of wasted or atrophied kidneys (not tantamount to loss of one organ) in 4,632.

Putting all forms and degrees of atrophy together, it occurred sixty times in 8,178 subjects. The St. Bartholomew's cases are not here included, because details as to this point were not ascertained.

CHAPTER IX.

FUSION OF TWO KIDNEYS INTO ONE—"SOLITARY" KIDNEY.

IT has been shown in the preceding chapters that there may be two kidneys in the body, but only one of them occupying the loin, the other organ being

movable or misplaced; even both may be movable or misplaced. But when both are misplaced they are generally more or less united.

We have now to consider in some detail the various degrees in which the kidneys may be fused into one mass.

Rokitansky has well described the two extreme

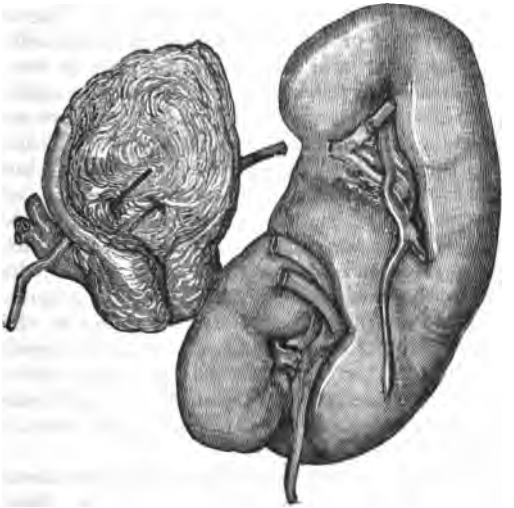


Fig. 7.—Fused Kidney; and the Bladder from same subject, showing the normal Orifices of the Ureters. (Preparation in the Middlesex Hospital Museum.)

degrees of fusion in the following words: "The lowest degree of fusion is seen in the horse-shoe kidney (ren unguliformis); the two kidneys are united at their inferior portions by a flat riband-like or rounded bridge of tissue, which crosses the vertebral column. In the higher degrees the two lateral portions approach

one another more and more, until they reach the highest degree, in which a single disc-like kidney lying in the median line, and provided with a double or a single calyx (pelvis) represents complete fusion."

An excellent example of an intermediate degree of fusion is described by Dr. Coupland. The general configuration is that of the normal left kidney, but with traces of lobulation. (*See* Fig. 7.) The upper and larger part of the mass is formed by the left kidney ; the lower and smaller part, which is less than half the size of the upper, represents the right kidney ; whilst the elongated central portion between the two ureters represents the renal tissue which usually unites the right and left halves of a horse-shoe kidney.

The convex border of the upper part, *i.e.* of the representative of the left kidney, looked upwards and to the left, the convex border of the lower part, *i.e.* of the representative of the right kidney, looked towards the median line, and therefore towards the right, as it normally does. In the hilum of the left organ the ureter was in front of the renal vessels ; in the hilum of the right organ the ureter and renal vessels have the normal relations to one another. Both ureters pass down in front of the organ, as is usual in horse-shoe kidney.

The right ureter crossed the middle line about the brim of the pelvis, and opened at its usual place into the bladder.

The bladder, with the orifices of the ureters, is also seen in the woodcut.

The whole renal mass weighed $6\frac{1}{2}$ ozs., and measured $6\frac{1}{8} \times 3\frac{1}{8}$ inches.

This is a good example of what may be regarded as a transitional form of solitary kidney, *i.e.* of a form holding an intermediate position between the horse-shoe kidney and that in which no indication of

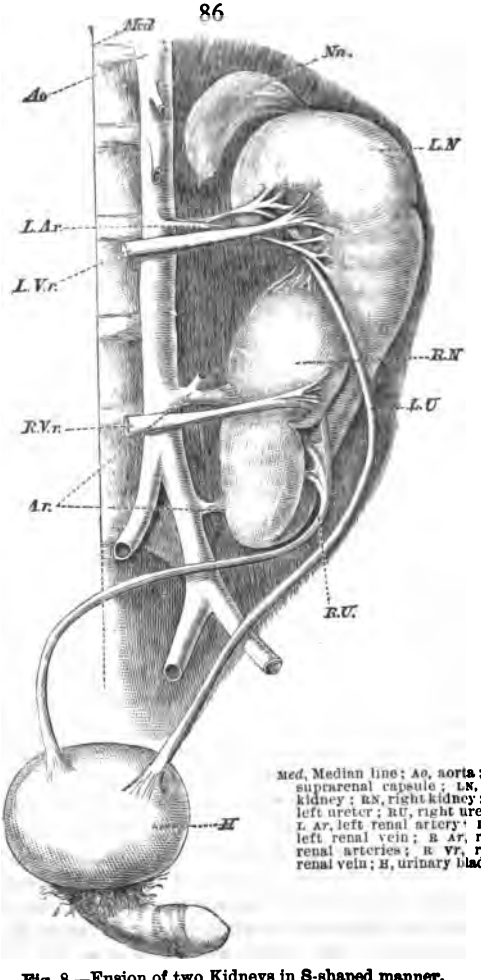
a division into two parts can be discovered externally, excepting perhaps by a bridge of renal tissue between the distinct and non-communicating pelves of the two ureters.

A very similar specimen to that described by Dr. Coupland is reported and illustrated in Virchow's *Archiv* for November, 1884.

Under the title of a case of congenital S-shaped fusion of both kidneys, Dr. G. Broesike, of Berlin, describes * a condition which, as distinct from the more usual "horse-shoe" kidney, he calls the "ren sigmoideum," from the resemblance of the congenital organs to the Roman letter S. The union in this preparation (Fig. 8) occurred between the upper extremity of the right kidney and the lower end of the left, the latter alone retaining its normal situation in the body; the right kidney thus lay wholly to the left of the middle line, and at first sight it was thought to be a case of complete absence of this organ.

The subject from which the preparation was made was a well-nourished male adult, and it is not recorded whether the right adrenal was present; but the site of the kidney was occupied on this side by a considerable quantity of fat. The left adrenal lay on a level between the eleventh and twelfth dorsal vertebræ; and the left kidney occupied nearly a normal position. Its hilum was markedly excavated, its vessels consisting of a much-divided renal artery and a single vein, the latter passing normally in front of the aorta. The origin of the ureter lay behind the vein, and between the arterial branches. United by renal substance to the lower end of this kidney was the right organ, which occupied a deeper but otherwise similar situation to what it would have had on the right side. Its hilum was thus directed to the

* Virchow's *Archiv*, 98, p. 338; November, 1884.



Med, Median line; Ao, aorta; RN, suprarenal capsule; LN, left kidney; RN, right kidney; LU, left ureter; RU, right ureter; L Ar, left renal artery; L Vr, left renal vein; R Ar, right renal arteries; R Vr, right renal vein; H, urinary bladder.

Fig. 8.—Fusion of two Kidneys in S-shaped manner. (Virchow's *Archiv.*)

left, its convex border being to the right, *i.e.* towards the median line. This second and deeper-lying kidney was smaller than the other, and clearly marked off from it by an oblique furrow traversing the anterior surface, and lodging the left ureter in its passage downwards and outwards. Posteriorly there was no indication on the smooth surface of a division between the congenital organs. The whole of this "double kidney" had an S-shaped form, and extended on the left side of the vertebral column from between the eleventh and twelfth dorsal vertebræ to the middle of the last lumbar. The hilum of the lower (right) kidney was somewhat deeply excavated. The renal vein passed out above the ureter in front of the organ, and crossed in front of the aorta. The arterial supply was by two trunks, one of which arose from the aorta, about three centimeters above its bifurcation, and entered the convex border of the organ; the other came from the left common iliac artery, and terminated near the lower border of the hilum. From the upper of these arterial trunks sprang a tolerably large vessel, probably the inferior mesenteric. As regards the ureters, the left, after passing along the furrow between the conjoined organs, ran downwards close to the hilum of the lower kidney, and thence in its usual course to the base of the bladder. The ureter of the lower (right) kidney, after a short course close to and parallel with the foregoing, passed transversely across the median line opposite the first sacral vertebra to the right common iliac vein, and thence took its normal direction on the right side of the pelvis to the bladder.

Dr. Broesike, in a few remarks on fusions of the kidneys, says that Meckel's (1812) original hypothesis of their origin in an arrest of development, although more recently adopted by Mühlhäuser (1861) has been disputed by Schultze, and also by Friedlowsky

(1869), who, on the ground of cases of his own, and the investigations of Küppfer (1865), concluded that the kidneys must be first developed separately; the fusion and change in site being a secondary occurrence, taking place during fœtal life. The case above described accords better with this latter doctrine. For, according to Küppfer, the permanent urinary system of mammals arises in the form of the so-called "renal canals," as blind offshoots from the posterior wall of the Wolffian ducts. These offshoots subsequently form the ureters and renal pelvis, and around the latter are grouped cells which eventually constitute the renal parenchyma. The "renal canals" necessarily undergo many changes in position, so that for a certain time both kidneys lie in front of the bifurcation of the aorta, and rest close together with their concave margins. To interpret the case described, one must assume that the normal changes of position did not take place equally on both sides, in that the right "renal canal" remained behind the left in its development, so that at a certain time the two kidneys, instead of being precisely facing each other, came to occupy different levels. At this early stage the kidneys are composed of separate lobes (the renculi), and in their subsequent fusion to form the kidney it is conceivable that the lobes of both kidneys became united into one mass. This implies that the altered position of the organs preceded their conjunction.*

There are other forms of the solitary kidney; *e.g.*

* Dr. P. W. Macdonald (*Lancet*, May 30, 1885) figures a solitary kidney having the general shape of the ordinary organ, but which on section "seemed to be one large kidney, with a smaller one joined on to its upper end. The smaller pelvis had separate and distinct pyramids." The renal mass weighed 11½ ozs.; it had two ureters and two pelves. The ureters entered the bladder normally; the one from the smaller pelvis passed behind the other to enter the bladder as the right ureter. This kidney was situated on the spinal column, and rested on the second, third, and fourth lumbar vertebræ.

there are in some cases four lobules or masses, looking like a quadruple instead of a double kidney (Fig.

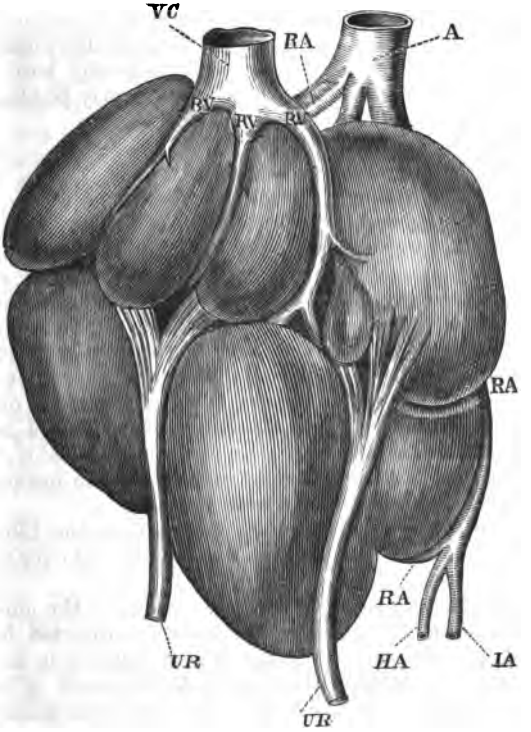


Fig. 9.—Fusion of Kidneys. The fused mass has a quadruple appearance. (After Botallus.)

A, Aorta; V C, vena cava; R A, renal arteries; I A, iliac artery; H A, hypogastric artery; R V, renal veins; U R, ureters.

9 of Botallus's case). In other instances again the two organs are fused into an unshapely mass, as in

a specimen with a double ureter, mentioned by Wilks and Moxon as having been removed from the pelvis, not the abdomen, of its possessor.

Thus, then, the solitary kidney is a compound organ, composed of two kidneys fused together; one of these at least must be, and very generally both of them are, misplaced. Solitary kidneys may be classified, according to their degree of fusion, into

1. Horse-shoe kidney;
2. Intermediate varieties;
3. The completely united, or disc-like kidney.

As a rule, each of these forms of solitary kidney has at least two ureters. Sometimes, however, though with exceptional rarity, when the two kidneys are united over the promontory of the sacrum, there is only a single ureter.

In a case related by Delafield * the solitary ureter opened into the bladder in the median line.† It is not, however, quite certain, from Delafield's own account, that this was a fused renal mass, and not an unsymmetrical kidney; though most probably, as Wilks and Moxon have assumed, it was an instance in which the two kidneys were united.

In each form of fusion of the kidneys the hilum is directed forwards, and the ureters descend over the front of the organ.

Rokitansky says: "The more intimate the union is, the more the hilum of the kidney is directed forward, so that whereas in the lowest degree it is indicated by an evidently increased development of the posterior labium of the hilum, the hilum in the highest degree of fusion occupies the anterior surface of the solitary kidney."

The same observer also remarks, that the more

* Delafield's "Post-Mortem Examinations and Morbid Anatomy," p. 206.

† Wilks and Moxon, p. 497.

considerable the fusion is, the lower are the kidneys situated; so that the completely fused organs are commonly placed over the promontory or in the concavity of the sacrum.

He was quite aware, however, that the solitary kidney, like the "unsymmetrical kidney," may be situated on one or other side of the vertebral column; but only in "exceptional cases."

Cruveilhier* says: "It is not very uncommon to find only one kidney, which is almost always formed by the union of the two by means of a transverse portion crossing in front of the vertebral column, and having its concave border directed upwards. Sometimes the two united kidneys are situated in the right or left lumbar region, or in the cavity of the true pelvis."

Wilks and Moxon speak of having seen two kidneys on the right side, and none on the left, but they do not state whether there was fusion or not.

The horse-shoe kidney.—This is the commonest form of fusion of the kidneys as well as the most frequent of the permanent misplacements of the kidney.

Cruveilhier, in the passage just quoted from his treatise on descriptive anatomy, refers to it as "not very uncommon;" and Velpeau says, "I have frequently found the two united in front of the spine." †

The usual condition is that the kidneys are joined together at their lower ends by means of a thick mass of renal tissue, so as to form a curved or horse-shoe-shaped mass, with the convexity downwards; the kidneys, throughout their extent, are much nearer the spinal column than normal, and at their junction rest

* "Traité d'Anatomie Descriptive."

† "Treatise on Regional Anatomy," p. 236. Translation by Hancock.

and two

solitary kidney, differing from most in this, "that the right lobe was distant from the left by no very great interval, the right being laid upon the left in the lower part, and divided with a sulcus on its anterior surface alone, so that an isthmus was formed not less slender than the lobes."

The frequency of horse-shoe kidney may be judged of by the following figures: of a total of 14,318 examinations at Guy's, St. Bartholomew's, the Middlesex, and the Hospital for Sick Children, Great Ormond street, the records of which have been looked over for the especial purpose, there were nine instances of horse-shoe kidney or about one in every 1,600 post-mortems.

There are many specimens contained in the London museums. In 1861 Dr. Gibb * looked through the London museums and found nineteen specimens which present various anomalies in regard to number of ureters and renal arteries. Others may have been added since. But neither museum specimens nor the records of cases in the Pathological Transactions can furnish the relative frequency of the abnormality. The above figures, however, help to do this.

The intermediate variety of solitary kidney is typified by the cases already referred to, of Dr. Coupland and Dr. Broesike, the shapes of which are seen in Figs. 9 and 10. Ebstein describes such-like cases under his second form of "*fusion of two kidneys* at single points." He says: "In the second form the union takes place in the middle by the two hili. In slight grades of the anomaly it is only a small connecting bridge which unites the two kidneys with one another. The highest grade has been observed by Meckel,† but even in that case the upper and lower ends were separated. In a few exceedingly rare cases the supernumerary renal parenchyma is not united to

* *Vide* Path. Soc. Trans., vol. xiii., p. 133.
† "Path. Anat.," vol. i., s. 616.

It weighed thirteen ounces and a half; and was formed, as usual, by the lower ends meeting over the spine, thus making the convexity downwards. The structure was healthy."

Though usually there are two pelves and two ureters, and a corresponding number of arteries and veins, there are exceptions to this also.

Monquiot * found a kidney from seven to eight inches long placed transversely across the lumbar vertebræ, which had four pelves, four ureters, and as many arteries and veins.

There is a specimen in St. Mary's Hospital museum having three ureters, two belonging to one half and one to the other.

Roberts mentions a specimen in which the two ureters of a horse-shoe kidney crossed each other on their way to the bladder.

Gebhard† saw a case in which one of the two ureters of a horse-shoe kidney had five branches; the other ureter was simple.

Roberts states that the arterial supply of a horse-shoe kidney always presents some departure from the ordinary distribution. Sometimes one or more arterial branches enter the convexity of the kidney.

Other variations in the horse-shoe kidney occur.

In one of Sandifort's cases (*see* Rayer) the left part of the horse-shoe kidney was larger than the right; but both had more arteries than normal.

Sandifort,‡ in a second case, found in a male subject the left kidney absent from the left loin; it was placed on the right side below the right kidney, with which it was united into a crescent (horse-shoe), and with which it formed an extraordinary shape.

Morgagni's case was a girl, aged six, who had a

* *Journal des Savans*, 1878, Mai 16; and Rayer, vol. iii.
† *Vide* Rayer, vol. iii., p. 771.
‡ Ibid.

solitary kidney, differing from most in this, "that the right lobe was distant from the left by no very great interval, the right being laid upon the left in the lower part, and divided with a sulcus on its anterior surface alone, so that an isthmus was formed not less slender than the lobes."

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* *Vide* Path. Soc. Trans., vol. xiii., p. 133.
† "Path. Anat.," vol. i., s. 616.

the two kidneys, so that the middle piece constitutes an independent kidney, which receives blood from both the lateral parts, but also possesses in part independent vessels." * In this variety the fused kidneys may occupy the normal position of one of them, as in Coupland's case and Virchow's; or the partially fused mass may be misplaced altogether either to the middle line of the abdomen or into the pelvis.

An interesting example of the intermediate variety is included amongst the cases of which I have the notes. It occurred in a man who died in Guy's Hospital with ascites, contraction of the vena cava, and a large gumma in the liver, causing pressure on the portal vein and hepatic duct. The two kidneys formed an irregularly shaped mass which weighed thirteen ounces, and was lying on the front of the promontory of the sacrum. It was not an ordinary horse-shoe, for the vessels and ureters were arranged most unusually. The central part of the mass was fissured by a sulcus, in which the ureter for the left kidney coursed downwards and the vein for the same upwards, passing into the vena cava just above the junction of the two iliacs. In the right half of the mass the ureters and vessels, instead of being situated centrally, were on its outer side; the ureter being in front of the vessels as in the left, and as is usual in fused kidneys. The arterial supply in each consisted of two or three arteries for each half of the mass about the size of radials derived from the common

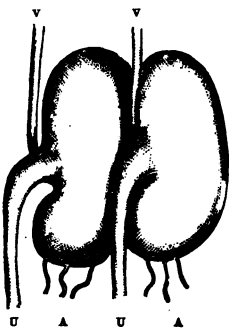

Fig 11.—Diagrammatic. U, Ureters; A, arteries; V, veins.

* Ziemssen, vol. xv., p. 777.

iliac arteries, and entered the lower part of each kidney. (*See* Fig. 11.) The suprarenal capsules were

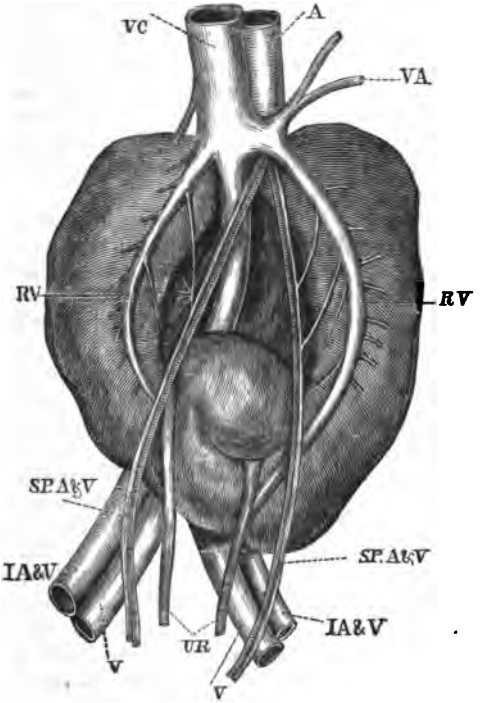

Fig. 12.—Two Kidneys blended, and occupying a median position. (After Haller.)

A, Aorta; V C, vena cava; V A, vena adiposa; R V, renal vein; S P A & V, spermatic artery and vein; I A & V, iliac artery and vein; U R, ureters; V, iliac vein.

in their normal positions. The renal substance, to the naked eye, was healthy.

The completely united variety of solitary

kidney is that in which the two organs approach one another so completely, that they form a single disc-like mass provided with a double or a single pelvis. It is what Rokitansky called the "highest degree" of fusion of the two organs. These completely fused organs sometimes lie in the median line, over the lumbar vertebræ, the promontory of the sacrum, or in the hollow of the sacrum; but this is not nearly so frequently the case as it is with the horse-shoe variety, the isthmus of which commonly rests across the lumbar vertebræ.

Haller illustrated (1756) a specimen of complete fusion of the two kidneys (Fig. 12); the mass occupied the median line, and possessed two ureters, and arteries derived from the aorta, iliac, and spermatic.

Dr. Greenfield* has described a case in which a kidney mass weighing seven and a half ounces, and measuring five inches in length, occupied the normal position of the left kidney. The general outline of this mass was nearly like the left kidney, though flatter and wider at the lower part. It was slightly lobulated, but there was no indication of division into two parts. The hilum was on the anterior surface and much farther outwards than usual, and was divided into two distinct parts, upper and lower, separated by a bridge of kidney substance. The two ureters and their pelves were quite distinct, and did not communicate in the organ. The upper passed somewhat inwards in the usual direction, and then downwards. The lower passed nearly vertically downwards in front of the organ, lying in a furrow on the anterior surface, which produced a sort of bifid extremity. On cutting into the organ a sort of faint line of demarcation, running obliquely across it, seemed visible at first, but was lost after the organ had been kept in spirit. There were two distinct sets of uriniferous tubules and pyramids.

* Path. Soc. Trans., vol. xxviii., p. 162; case 1.

The structure was healthy. The ureters entered as usual into the bladder. The renal artery was single and in the normal position of the left, but it divided near the hilum into two trunks, which gave branches to the two divisions. The suprarenal capsules were normal.

Dr. Kelly * has recorded a very remarkable case in which *a right-sided* kidney mass in a female was lying vertically along the spine having a convex outer border. It weighed ninety-three ounces. There were three arteries and two ureters. The upper ureter descended in the usual manner, and was situated most anteriorly in position in front of all the vessels; the lower one, after passing behind it, followed the course of the left common iliac artery, and entered the bladder in the usual place.

Dr. Duckworth † mentions a specimen which was in the Pennsylvania Hospital museum, of a renal mass which was situated on the right side of the pelvis instead of the abdomen; it had two ureters, which entered the bladder at the usual places, and two renal arteries. The general outline of the mass was circular.

Dr. Butler has figured a case of fused kidneys of elongated form and which reached from the body of the fourth lumbar vertebra to the middle of the sacrum. It measured five inches in length by three and three-quarters in breadth; had a central longitudinal fissure or raphe better marked behind than in front; and two ureters united above in a single pelvis, and thus attached to the middle of the anterior surface, but terminating at the bladder in the usual manner. Four arteries supplied the mass; one large trunk from the fork of the aorta, two from the left internal iliac, and one from the right internal iliac.

There is a single renal mass in St. Bartholomew's museum, twelve inches long.

* Path. Soc. Trans., vol. xix., p. 274. † Ibid., vol. xx., p. 233.

In Dr. Delafield's case the two kidneys were united over the promontory of the sacrum, and there was only a single ureter which entered the bladder in *the median line.* In a case mentioned by Wilks and Moxon the two kidneys were united into an unshapely mass which lay in the pelvis.

Morgagni * gives a case, already referred to, in which both ureters went to the right side of the bladder. It was in a woman who died of dysentery, and who had no left kidney; but this deficiency was supplied by the right, which was twice as large as natural and had a double pelvis as well as a double ureter. It is doubtful whether this should be regarded as a "fused" or an "unsymmetrical" organ.

CHAPTER X.

SYMPTOMS AND DIAGNOSIS OF SINGLE KIDNEY.

There are no symptoms which can be attributed to unsymmetrical, solitary, or congenitally atrophied kidneys. If the renal substance of the existing organ is healthy, the excretion of urine goes on naturally and the health and physique of the person may be perfect. Probably, as has been above stated, there is a tendency to chronic albuminuria in early or young life in persons with one kidney atrophied. When only one kidney exists, and that an "unsymmetrical" organ, there would seem to be a considerable disposition to renal calculus. Of the twelve cases of unsymmetrical kidney collected by Mosler, death was due more or less directly to calculus in the pelvis or ureter in nine of them; in the other three, cancer of

* Letter xxxi., art. 25; xlviii., art. 16.

the bladder and rectum involving the ureter; nephritis; and the consequences of obstruction, due to severe congenital phymosis, were respectively the causes of death. In the case of cancer (Tulpius), a calculus had been passed per rectum in early life, and there was an opening from the ureter into the rectum through which part of the urine escaped.

In Rayer's list, six cases of unsymmetrical kidney were affected with calculus, but three of these are the same as Mosler's. Rayer also gives one case of atrophic and one of fused kidney affected with calculus. In the atrophic case, the atrophy was due to a calculus ten drachms in weight, and the kidney was suppurating and entirely destroyed. Mr. T. Wilmott * published a case of sacculated nephritic abscess in a patient with only one kidney, due to impaction of a calculus, the size of an almond, in the commencement of the left (the only) ureter. There was no kidney on the right side. The left kidney weighed twenty-eight ounces. The patient was a woman aged thirty. Mr. F. E. Manby,† has recorded a case of cancer of an unsymmetrical kidney in a painter, aged forty-eight years.

In other cases of unsymmetrical kidney there has been hydro- or pyo-nephrosis due to some cause undetected; in one or two instances the quantity of urine excreted has been very small, the bladder was small, and the patient has subsequently died dropsical. Many persons with an unsymmetrical kidney have lived to advanced life, and died of disease unconnected with their kidney. In solitary kidneys the danger to life from possessing only a single organ is not nearly so great, because there are, as a rule, two independent pelves and ureters, and therefore the risks of plugging of one ureter are much the same as when the

* *Brit. Med. Journal*, Nov. 24, 1883; p. 1014.
† *Lancet*, April 11th, 1885.

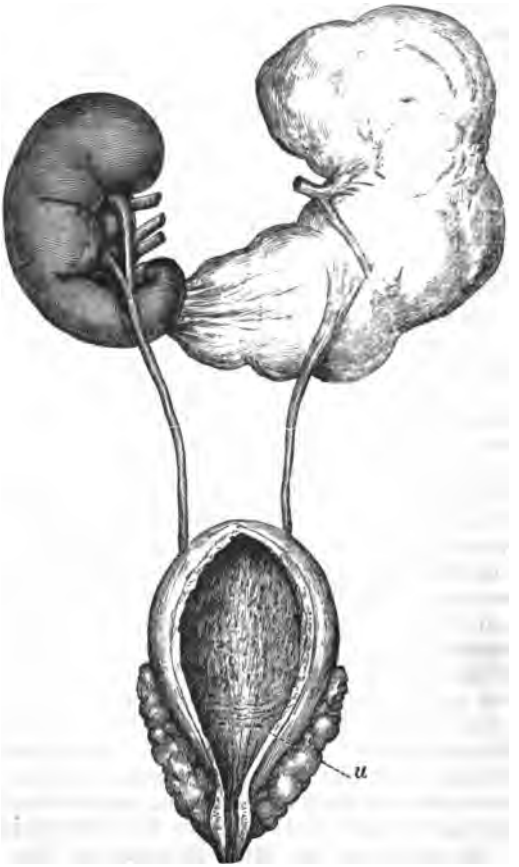

Fig. 13.—Horse-shoe Kidney, with Ureters and Bladder. The left half of the renal mass was converted into a large thin-walled pyonephrotic cyst. (Middlesex Hospital Museum.)

kidneys are distinct and in their proper positions. This is even more true of horse-shoe kidneys than of the more completely fused organs. Sometimes one-half the horse-shoe organ is completely destroyed, the other half being quite uninvolved. This is seen well in the accompanying figure (Fig. 13) taken from a specimen added to the Middlesex Hospital museum, by Mr. Clark; one-half of the horse-shoe was converted into a cyst filled with pus; the cause of the disease was not ascertained. The patient had passed pus with his urine during life. Somewhat similar but less well-marked cases are recorded.

In another case, of which I have notes, one-half of the horse-shoe kidney was dilated and suppurating, and the cellular tissue around it was inflamed.

In the case of a young man, aged twenty-seven, with horse-shoe kidney, reported by Dr. Gibb,* the entire organ was in a state of Bright's disease.

Piccolhominus† and Azzaritti have hinted that ill consequences sometimes arise from the pressure of the isthmus of a horse-shoe kidney on the aorta and vena cava; the latter, in this way, accounted for an aneurism in the first part of the abdominal aorta (*i.e.* between the pillars of the diaphragm), which eroded the vertebræ and subsequently ruptured into the left pleural cavity. Generally, however, the isthmus is very thin, or even fibrous, and does no harm by its pressure on the large vessels. Nor is there, so far as I know, any reason for attributing to it any disturbance of the sympathetic system.

The size of single kidney is, in some instances, very great. In Dr. Kelly's ‡ case of complete fusion the renal mass weighed ninety-three ounces. No tumour had been detected during life.

* Path. Soc. Trans., vol. xiii., p. 132.
† Morgagni, Letter xlviii., art. 16; vol. iii., p. 719.
‡ Path. Soc. Trans., vol. xix., p. 274.

Morgagni refers to a case in which one kidney, as the result of atrophy of the other, was ten times larger than natural; and to another case in which a kidney weighed thirty-five pounds; and again to a third, noticed also by Fantonus, in which the one kidney was more than twice this (thirty-five pounds) weight.

Other cases are referred to as of "surprising bulk and magnitude" (Fernelius); or as "of an almost incredible magnitude and breadth" (Boreus). In these cases, however, it is probable that disease was superadded to hypertrophy.

It might easily happen that a horse-shoe kidney, or two kidneys more or less completely fused and situated in the median line of the abdomen or in some part or other of the pelvis, might give rise to the opinion that a morbid growth existed. This would be more especially apt to occur if the abnormal kidney mass could be readily felt by palpation of the abdomen, or by examination per rectum or per vaginam; and still more likely if, in addition, the person was an invalid, or suffered from pains in the abdomen or pelvis, due to some other cause; or if hydro-nephrosis or pyo-nephrosis affected the organ thus misplaced.

In the days before abdominal surgery was much practised, as well as since ovariotomy has been established as one of the most successful operations, renal tumours had been recognised amongst the "causes of false pregnancy." By the writings of those who had preceded them, even the earliest ovariotomists might have been, and doubtless some of them were, cognisant of the possibility of such errors in diagnosis. But by the mistakes of ovariotomists, nephrectomy was performed before it was admitted to be, or advocated as being, a scientific operation.

In the Sepulchretum, amongst the conditions which resemble pregnancy is mentioned prominence of the belly from the size and position of a solitary kidney.

Rhodius, in 1661, recorded a case of solitary kidney which occupied the middle line, and was of such a size that the woman was thought to be pregnant.*

Vesalius wrote† that sometimes in those who "have the belly exceedingly prominent, and the order of the ribs vitiated, he had seen a solitary kidney, and that a very large one; placed upon the vena cava and the large artery." Eustachius‡ refers hesitatingly to the same prominence of the abdomen, but does not confirm it by the account he gives of a solitary kidney lying on the middle of the spine. Morgagni could not doubt that when a bulky solitary kidney rests on the spinal column the belly would be prominent; he quotes the case of a woman who was supposed at first to be pregnant, but in whom the abdominal enlargement was proved on dissection to be due to a solitary kidney. He adds that Spigelius might have suspected pregnancy, had the subject been a female, in a case of solitary kidney very similar to that of the woman just mentioned.

Morgagni adds, however, that the suspicion of pregnancy in such cases can only occur to the individual who is about to make the post-mortem inspection, because during the life of the woman the clinical history and duration of the tumour would prevent one from going astray in one's diagnosis. The solitary, centrally placed kidney will probably have been of congenital origin; the pregnancy of but a few months' duration.

When, however, one or other of the kidneys has grown large from disease, we must quite recognise the possibility of committing an error in diagnosis.

It is, indeed, far less probable that a single kidney, even if of large size, when situated over the

* Rayer's "Maladies des Reins."
† "De Corpore Humani fabricâ," lib. v., cap. 10.
‡ "De Renibus," cap. 10.

vertebral column, will be mistaken for pregnancy or ovarian cyst or uterine myoma, than that a cystic or solid enlargement of the kidney will be thus regarded. The important point in either case, however, is for the surgeon who contemplates operative treatment to ascertain whether the enlarged kidney is single or not.

In some thin subjects the kidney can be made out in the loin by manipulation and palpation. But this is not always possible. Now there is one feature which has been found associated sufficiently often with misplaced, movable, unsymmetrical, horse-shoe, and other forms of solitary kidney, to make it worthy of special attention. I refer to malformation and abnormal development of other parts and organs of the same body. While treating of misplaced kidneys, I have mentioned that the large intestine is comparatively frequently transposed or abnormally disposed, but many other and more striking and noticeable deformities have been also observed.

I have made for myself a list of such cases, which I have met with in my reading or otherwise. It was seen from this list that defects of the generative organs are very prone to be associated with abnormalities of the kidneys.

The association between the absence of both kidneys and defective generative organs will be noticed again in the following chapter. The practical rule for surgeons to bear in mind is, therefore, that if nephrectomy is contemplated on a person who has any congenital malformation or deformity, and more especially if the malformation or deformity is of the genito-urinary system, very particular precautions must be taken to ascertain whether there are two kidneys or only one. In such cases it may perhaps be proper to select abdominal rather than lumbar nephrectomy; or if the lumbar is much preferred for any valid reason, it may be requisite to previously explore the opposite loin to establish the

existence of a second organ. In nephrotomy and nephro-lithotomy this precaution is not necessary.

METHODS FOR ASCERTAINING THE PRESENCE OF SECOND KIDNEYS.

Various methods have from time to time been suggested for ascertaining the presence of two kidneys; and the same have been considered applicable for determining the condition of the kidney which is to remain behind after nephrectomy. The following are the chief of them:

(1) Catheterisation of the ureters. A very difficult procedure, of which Polk, of New York, has written, "The method of Simon (catheterisation of the ureters) was now open to me; but the fact that, in common with many others here, I had tried this method several times, and had never succeeded (save when a large vesico-vaginal fistula existed), made me feel the attempt would be futile."

(2) Exploration of the loin with the hand introduced into the rectum. This is not always possible, and is never very easy. Moreover, it requires a small hand for its accomplishment. When feasible it can only give information as to the presence and size of the organ, but none as to its structural condition. Moreover, it is not by any means free from danger, and I have known in one instance the rectum lacerated just above the peritoneal reflexion, by the finger catching in a large fold of mucous membrane.

(3) Exposing and ligaturing temporarily the ureter of the kidney to be removed, by an incision such as that employed for tying the common iliac artery. The bladder is then to be washed out and the urine excreted by the other kidney examined. The operation is no simple one, and is attended by considerable disturbance of the subperitoneal fascia.

(4) The examination of the renal regions through

an anterior abdominal incision. By this method the presence of a second kidney can be ascertained, but its condition cannot. Glück suggested that the ureter should be clamped or ligatured, and a subcutaneous injection of iodide of potassium given, and the urine examined a few minutes after for iodine. A serious and dangerous proceeding, and one necessitating abdominal section before arriving at a diagnosis.

(5) Wash out the bladder, after compressing the ureter of the kidney to be removed by means of Davy's rectal lever (Weir), or by the hand in the rectum (Dr. Sand's recommendation).

A chemical examination should be made of the urine which then flows into the bladder.

(6) Polk,* of New York, has propounded the following plan. "Take a large catheter made of some substance like block tin, bend it to the shape of a Sim's sigmoid catheter; let the curve that passes into the bladder be as decided as it can be made, and yet not so great as to interfere with the ready passage of the instrument into the bladder. Suppose it to be the right ureter you desire to close. Introduce the instrument; then place the patient in the lithotomy position. Now carry two fingers as far into the rectum as possible. An instrument curved and grooved to receive the catheter might be substituted for the fingers for counter-pressure. Now place the catheter so that its curve in the bladder hugs the right pelvic wall; the end of the curve will pass directly across the line of the right ureter. Now press the fingers against the catheter, and the ureter will be sufficiently occluded to prevent all escape of urine.

"By means of the catheter in position (it may be double) you thoroughly cleanse and empty the bladder.

"As fresh urine flows in from the other ureter it

* *New York Med. Journal*, Feb., 1883.

can be withdrawn and tested. As urine from a sound kidney is secreted at about the rate of a minim in four or five seconds, it will not require long-continued pressure to secure the amount of urine necessary for satisfactory examination. In the female the procedure is more certain of accomplishment than in the male, because we can, in a measure, fix the base of the

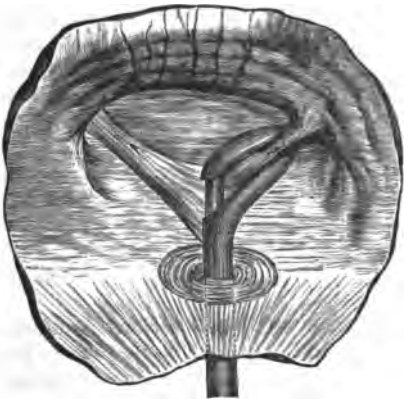

Fig. 14.—Dr. Tuchmann's Ureter Forceps applied to the Orifice of one Ureter.

bladder by traction upon the anterior vaginal wall by means of a tenaculum hooked into it just below the cervix; or, better, well to the right of the cervix, on the lateral wall; the traction being downwards and to the patient's left."

(7) Dr. A. Tuchmann, of the staff of the German Hospital, Dalston, has invented the instrument called "ureter forceps." He has given me the following description of it, and the mode of applying it. (*See* Fig. 14.) It is like a lithotrite, but more slender; its branches are made to approach each other not

by the force of a screw, but by a slight spring; it has large holes to allow the urine to flow out from the bladder.

The instrument has the purpose, when introduced into the empty bladder, to close during a certain time the valve of the ureter of the one kidney, and to collect the urine which, during this time, comes down from the other kidney.

In the empty living bladder the valves of the ureters are very prominent; they are also in a fixed position relative to the opposite part of the posterior wall of the bladder, which wall here, near the bottom of the bladder, is very inextensible and cannot be pushed back more than half an inch.

The branches of the instrument, when drawn asunder, leave a space of a little more than half an inch between each other, so that when the instrument is pushed towards the posterior wall of the bladder, the valve is getting between the two branches.

Besides this, we have various anatomical and physiological guides which show us that we are on our right way and have succeeded in our design; these signs are:

(1) A certain feeling of resistance which informs us that we are on the bottom of the bladder.

(2) More certain still in this respect is the peculiar feeling which we get when the beak of the instrument passes over the base of the trigone.

(3) The part immediately behind the valves is comparatively narrow in the transverse direction, so that when we move the branches sideways towards the origin of the valve, we are very soon arrested by the lateral wall of the pelvis, whereas the higher regions of the bladder are much wider.

(4) The instrument is quite immovable when we have seized the valve.

(5) When the valve is really closed a much smaller quantity of urine appears, and when we after some time let it go the large quantity of urine streaming out is very striking.

(6) An instrument for temporarily closing either ureter has been figured and described by Dr. Oscar Silbermann, of Breslau.* It consists of a metallic double catheter with a sharp curve, and a window (3½ cm. by 5 mm.) near its point which can be closed by the movement of a stilet. Within the catheter is a firm elastic catheter terminating in a small expansible guttapercha balloon or tampon, which is also within the outer catheter as long as it is collapsed. On opening the window of the outer catheter the tampon of the inner tube is expanded by pouring quicksilver into it. The tampon when filled is the size of a goose's egg, and contains 20 c.cm. of mercury, which weigh about 270 grms. The ureter is compressed by the weight of this tampon, which can be guided by the finger in the vagina or (in the case of the male) in the rectum to either side of the median line. After emptying and washing out the bladder through the second channel of the metallic cannula sufficient urine from the unclosed ureter will collect in from fifteen to twenty minutes to afford an opportunity for chemical and microscopical examination.

Silbermann had used this instrument twenty-two times in women and five times in males, and found no discomfort or ill consequence from its application.

(7) Dr. Newman, of Glasgow, † has devised an electric lamp which he introduces into the bladder so as to illuminate the orifices of the ureters. Into each ureter he inserts a catheter, and thus collects the urine from each kidney separately.

The instruments required for this proceeding,

* *Berlin. Klin. Wochenschr.*, No. 34, August, 1883.
† *Glasgow Med. Journ.*, Aug., 1883.

besides the electric lamp, are two gum-elastic catheters and a speculum; all of which are occupying the urethra at the same moment. The bladder is previously washed out with a warm solution of boracic acid, and distended with eight ounces of the boracic solution.

It is needless to say that this method is inapplicable in the male, and needs modifications in its form even for females.

None of the methods yet devised can be considered satisfactory.

CHAPTER XI.

ABSENCE OF BOTH KIDNEYS.

The absence of both kidneys has many times been made out by Rayer and others in the fœtus and in children still-born at full time. Beclard * states that the kidneys are often wanting in acephalous monsters, but that one kidney at least is always present when a certain length of the vertebral column is developed. M. Moulon,† of Trieste, has recorded the case of a young girl fourteen years old, who died of chronic gastro-enteritis, and in whom neither kidneys nor ureters were found. The umbilicus was situated where ordinarily the "mons veneris" is. The symphysis pubis was replaced by a wide gap, covered only by the skin. The bladder was wanting. The urachus (l'ouraque) very large and long, was lost gradually in the integuments. The umbilical vein greatly surpassed that of an adult. The uterus, ovaries, and Fallopian tubes were perfect. The external genitals

* Beclard, "Mém. sur les Acephalés"; Bullet. de la Faculté de Méd. de Paris, tome vi., p. 497.

† Archives Générales de Médecine, tome xvii., p. 424.

were very defective, and the anus, which was inordinately large, opened where the vaginal orifice should have been. From birth this young woman had been subjected to a continual discharge of a liquid very like urine from the umbilicus. The fluid which flowed thence had such a penetrating odour that it was impossible for her to change her linen often enough to be free of smell. M. Moulon concluded that the blood in this case gave up those constituents which go to form the urine, to the liver; and that they were conveyed by the umbilical vein to the umbilicus and there excreted. The liver was gangrenous, as were the intestines in spots throughout their extent. The pancreas was converted into a sac of pus, and the great omentum was in part destroyed.

Rayer quotes M. Moulon's case, but with great mistrust; he considered that the real condition was atrophy of the bladder, and that the kidneys were congenitally misplaced, but overlooked because not properly searched for at the post-mortem examination. This opinion does not seem to be borne out by the description of the post-mortem examination, for from the report it would appear that all the abdominal and pelvic contents were thoroughly investigated.

If M. Moulon's case is trustworthy, it enables us to understand certain published cases of congenital hydro-nephrosis, and others of *anuria* lasting over many months.

Vieusseux, of Geneva,* speaks of a case of prolonged suppression of urine in a young girl of eleven years of age. The suppression lasted seventeen months and then the excretion of urine was re-established.

Dr. Polk's † case has proved that a young person of nineteen years of age can live for nearly twelve days

* *Journal Médical*; Corvisart, Leroux, et Boyer, tome vii.; vendémiaire, an. xii.

† *New York Medical Journal*, Feb. 17, 1883.

after being suddenly deprived of her only kidney; and that during the last days of her life a small quantity of fluid containing urea was discharged from the bladder. This fluid might have been a small quantity of urine which was left in the ureter after the nephrectomy, and which only slowly reached the cavity of the bladder. Moreover, vomiting and purging are frequent symptoms during suppression, and by these means some of the constituents of the urine are removed from the blood, though at length exhaustion supervenes, and death, preceded by coma, occurs. Such cases, while they show how difficult it is for the excretion of urea and uric acid to be efficiently carried on by tissues and organs suddenly called upon to perform such unaccustomed functions, do not disprove, but on the contrary help somewhat to make us give credence to the idea that when both the kidneys are congenitally deficient life may be rendered possible for a time by the liver and intestines vicariously assuming the renal functions. Vieusseux's case shows that life may continue for many months together, in spite of complete cessation of all secretion from the kidney, in a young person whose renal organs had previously performed and did subsequently perform their full duties. Numerous cases of fœtuses without kidneys, but in many if not all other particulars fully developed, show that the absence of renal organs is not incompatible with intrauterine development, and existence up to full time.

Mayer, of Bonn, published * a case of a stillborn male infant of full term, the lungs, heart, liver, spleen, and greater part of intestines of which were normally developed, and the suprarenal capsules were about twice their normal size, though the kidneys, ureters and urinary bladder

* *Zeitschrift, für Physiologie;* and *Journal des Progrès*, tome iv., p. 281; 1827.

were completely wanting. The gall bladder, external genitals, sigmoid flexure, rectum, and anus were also absent; and the spinal cord terminated in a club-shaped extremity opposite the second dorsal vertebra, though the vertebral column was continued as far as the fourth sacral vertebra. The sciatic, obturator, and crural nerves were, however, almost of normal size; but the abdominal sympathetic was less developed than usual around and about the intestinal arteries. The abdominal aorta was nearly normal, but gave off no renal branches. The testis and epididymis on each side were small, and the vasa deferentia terminated in cellular tissue in their serous tunic. There were other minor vices of conformation besides the above. As Mayer remarked, it appears from this case that the most important functions of animal and organic life can go on, at least during intra-uterine life, without the assistance of the urinary organs. Mayer also raised the question whether the development of the spinal cord is not a necessary condition for the development of the urinary organs, and he refers to the Memoire of Tiedmann, in which this theory is discussed.

Rayer, who cites Mayer's carefully reported case very fully, gives references to several analogous cases; as well as to cases of double monsters (la duplicité monstrueuse par inclusion) in which the kidneys were wanting.

Chaussier * also exhibited the trunk of a fœtus, in which there were neither kidneys, uterus, nor urinary bladder.

I will again remark that it is interesting and important to the surgeon to notice how frequently abnormalities of the external or internal genital organs, or of both, co-exist with the absence of one or both kidneys.

* Bull. de la Faculté de Méd. de Paris, p. 35; 1810.

CHAPTER XII

INJURIES OF THE KIDNEY—SUBPARIETAL INJURIES.

INJURIES which involve the kidneys are of various kinds. Like those which happen to the intestines and other abdominal viscera, they may be conveniently considered under four heads.

1. Subparietal injuries of the kidney, or those in which no open wound communicates with the injured organ.

2. Those in which an open wound communicates with the injured kidney.

3. Prolapse of the *injured* kidney through an external wound.

4. Prolapse of the *uninjured* kidney through an external wound.

The relative frequency of these several forms of injury in civil life is suggested by the following post-mortem records; out of two thousand six hundred and ten inspections of persons dying of all kinds of injuries and diseases, there were thirteen of injured kidney; of these, twelve were subparietal and one a penetrating wound.

Subparietal injuries.—These are by far the most common. They vary much in severity; from the slightest contusion attended with a little hæmaturia, but without any obvious lesion of the renal tissue or pelvis, to complete rupture of the organ into two or more separate parts. Rupture of the kidney is by no means an unfrequent accident, despite the protected situation of the organ, and its envelope of fatty areolar tissue.

Causes.—The causes of subparietal injuries are generally crushes and direct blows upon the abdomen,

loin, and lower part of the thorax, falls from a height, and the forcible doubling up or bending of the trunk either antero-posteriorly or laterally.

The passage of carriage wheels, buffer accidents, shell contusions, the falling in of earth upon the body, the compression of the trunk between two resisting surfaces, such as a wall and the pole of a carriage, or the platform and the footboard of a railway carriage, direct blows upon the loin or the ilio-costal interspace in front, are the common kinds of accidents which lead to them. Falls from a height cause injury to the kidney in two ways at least, either by direct violence, the trunk striking against some hard body in the act of falling, or by the sudden and very forcible flexure of the trunk upon itself as the person alights upon the ground. In some instances the first effect of the violence seems to have been the fracture of one or more ribs, the kidney being wounded by the end of a fractured rib.

Pathology.—The nature of the wound of the kidney varies much. Of twelve cases of subparietal injuries of the kidney, the notes of which are before me, seven were lacerations, *i.e.* partial ruptures, which extended through half the thickness or less of the organ; two were complete ruptures, the injured kidney being divided into two separate portions; in the tenth case the kidney was crushed to pieces, almost into a pulp; in the eleventh, blood was extravasated beneath the fibrous capsule of the kidney, but the renal substance was not ruptured; and in the twelfth there was blood in the pelvis of the kidney, but no rupture, and the source of the bleeding could not be found. In this last case the abdomen had been run over by a carriage, and death was caused by laceration of the liver.

In quite the majority of cases blood in considerable quantity was extravasated into the circumrenal

cellular tissue. This would be expected as a matter of course in cases of complete rupture, or when the kidney is very much crushed, but it is also found in cases where there is no laceration whatever of the renal substance. Thus in a case in which blood was effused between the capsule and the cortex of the kidney, and in another in which the only change in the kidney was the presence of a little blood in the renal pelvis, there was a considerable amount of blood extravasated in the cellular tissue around the kidney.

When complete rupture occurs the hæmorrhage is sometimes very great, as in a case recorded in Guy's Hospital Reports.* A young man fell against the edge of a cask whilst deeply intoxicated, and died in twenty-seven hours in a state of collapse; at the autopsy the left kidney was completely divided transversely through its middle into an upper and lower half. There was extensive and general extravasation beneath the peritoneal coats of all the viscera, excepting the liver, and an enormous coagulum of blood was found in the left lumbar region, extending from the diaphragm to Poupart's ligament, and also across the spine. The viscera, more especially on the left side of the abdomen, had been raised forward by the effused blood.

If recovery takes place extravasated blood may remain in great part unabsorbed without giving rise to further local change, as is proved by the case† of a man who died eighteen months after he had been kicked by a horse on the right side of the abdomen. Both kidneys were very granular and full of cysts. The cellular tissue around the right kidney was consolidated, a large clot of blood occupied its pelvis and interior, and communicated also with the exterior, where a large quantity

* Second series, vol. ii., p. 424; case 20.

† *See* Catalogue of St. George's Hosp. museum; and Trans. Path. Soc., vol. xi., p. 140.

of blood clot was lying in the subperitoneal tissue. The line of rupture could be faintly traced through the substance of the gland. The ureter, where cut across (about one and a half inches from the kidney) was found quite impervious.

This case shows also another important fact, namely, that the ureter and renal pelvis may become quite plugged by extravasated blood, and that in this way the channel from kidney to bladder may be permanently obliterated.

The plugging of the renal pelvis with blood may be the only visible change in the kidney. This was seen in the case of a woman who was run over, and whose death occurred from rupture of the liver; the left kidney was nowhere lacerated, but the pelvis was occupied by blood, the source of which could not be detected.

When the kidney is completely ruptured, and the peritoneum covering it is also torn (an accident likely to occur from very great violence inflicted upon the front of the abdomen) the hæmorrhage may be great and suddenly fatal. In the Guy's Reports* there is the record of a case of a lad, aged eight and a half years, who was suddenly and forcibly struck on the abdomen by the handle of a truck, and died within an hour. At the post-mortem examination the upper extremity of the right kidney was completely torn off, and about a quart of blood, but little clotted and generally diffused, was found within the cavity of the peritoneum.

In other cases blood is effused behind the peritoneum from ruptured kidney, and into the cavity of the peritoneum from rupture of some other viscus. A man,† aged twenty-four, over whose body a railway carriage probably passed, died five hours after the

* Second series, vol. ii., p. 485; case 21. 1844.
† Guy's Hospital Reports, case 22. 1844.

accident; on examination, a pint and a half of blood was found poured out behind the peritoneum, and the right kidney was much torn, and cut nearly into two parts; within the peritoneal cavity were eight ounces of blood, and in the convex surface of the right lobe of the liver was a rent three or four inches in length, and penetrating deep into its structure.

In St. Bartholomew's Hospital museum there is the right kidney from a lad, aged nineteen, who was crushed by the pole of a van against a wall. Bloody urine was drawn off by the catheter during life. Death took place twelve hours after the accident. The abdomen was found full of blood clots; the lower portion of the kidney had been torn off; the liver was much lacerated; the tenth rib was fractured.

Laceration and rupture of the kidney may take place in any direction, vertically, obliquely, or transversely. Sometimes the laceration is superficial, and limited to one surface only. Sometimes there are several lacerations of different length and depth. When the rupture is complete, one or the other end of the kidney may be broken off, or the rupture may run transversely across the centre, extending through renal substance and pelvis as well. In one of my cases the right kidney was ruptured right through its substance, the rent commencing at its upper border and extending downward obliquely to its centre; there were, besides, two small lacerations in the lower part of the organ. Assistant-surgeon Gunn* saw a case in which death had been caused by hæmorrhage from the right kidney, which had suffered complete longitudinal laceration by the passage of a waggon wheel.

Sir J. Fayrer† found in a Hindoo, who died from tetanus sixteen days after a fall from a height, an

* "Med. and Surg. History of Wars of Rebellion," vol. ii., part ii., p. 20.

† Fayrer, "Chir. and Path. Observations in India," p. 591.

extensive rupture of the left kidney, running from its upper end to the hilum, and the areolar tissue surrounding the vessels at their entrance into the hilum was densely infiltrated with blood. Besides compound injuries to the fore-arms, both liver and spleen were also ruptured. There was no peritonitis.

Blood may be extravasated beneath the fibrous capsule or into the pelvis of the kidney without any laceration or rupture of the substance. On the other hand, the kidney may be well-nigh converted into a pulp, either as the direct result of an injury, or of the inflammation to which an injury gives rise, with but little, or even without any, extravasation of blood into the tissue around. When life is prolonged for some weeks or months, pyo-nephrosis and renal abscess are by no means rare sequelæ of an injury (either contusion or laceration) of the kidney. Mr. Pollock has recorded such a case in his article in the "System of Surgery."* Perinephric abscess and complete tumefaction of renal substance are also occasional consequences of a blow in the loin. These changes are more likely to follow if a calculus is contained within the injured organ. I have recorded such a case in the chapter on perinephric abscess. (*See* pages 220, 221, and Fig. 15.)

A strain or partial laceration of the pelvis or ureter may be followed by adhesive inflammation and obliteration of the urinary duct. Hydro-nephrosis may ensue within a week or two, and lead to a tumour in the loin; and this, after a succession of tappings, may cease to refill, owing to the complete destruction of the secreting substance of the injured kidney. An illustrative case of this sort is described by Mr. Croft.† Mr. Stanley's‡ was, perhaps, a similar one to Croft's;

* Holmes, "System of Surgery," vol. i., p. 882. 3rd edition.
† Trans. Clin. Soc., vol. xiv., p. 107.
‡ Med.-Chir. Trans., vol. xxvii.

or it may have been a case of torn pelvis of kidney, not one of ruptured ureter, as it is so often quoted as being. In other cases of lacerated pelvis of kidney, large retro-peritoneal extravasations of blood and urine may occur, or the kidney, in the course of months or years, becomes converted into a number of abscess sacs, owing to pyo-nephrotic distension of the calyces, and the ureter may atrophy after becoming quite impervious.*

Of the twelve cases of subparietal injuries in my list, the right kidney alone was involved in eight, the left alone in one only, and in three there were lesions of both kidneys. In ten instances the liver was ruptured as well as the kidney, and in some of these there was rupture of the spleen, or lungs, or both, as well as of the kidney. Of the ten cases in which the liver was ruptured it was the right kidney alone which suffered in six; and both kidneys in three, the left being most injured in one of the latter. Many recorded cases also show that when the right kidney is injured the liver is very commonly damaged also. The right kidney is, however, sometimes the only organ injured. This was the case in a lad, æt. 15, who was run over by a cart and died very shortly after from extravasation of blood into the subperitoneal tissue.†

When a fall has been the cause of the injury, fractured ribs, fractured pelvis, or fractured skull may complicate the rupture of viscera. In four out of ten cases in which the liver as well as the kidney was ruptured the ribs were fractured also, and in two other cases there was fracture of the skull.

Despite the protected situation of the kidney, it may be injured in persons of all ages or either sex. Of

* Mr. Haviland has recorded such a case; Path. Soc. Trans., vol. x., p. 209.

† *See* St. George's Hospital Museum catalogue.

twelve fatal cases, seven were men, three women; in two the sex is not stated.

Symptoms.—It may be stated at once that the hæmaturia following an injury to the loin, or the front of the ilio-costal area of the abdomen, is not necessarily symptomatic of *ruptured* or *lacerated* kidney; and, on the other hand, that hæmaturia is not always a symptom when the kidney is severely lacerated or completely ruptured. If the ureter becomes plugged by clot, so that neither blood nor urine can get down to the bladder from the injured organ, hæmaturia cannot occur, and the kidney may be ultimately lost as an excreting organ. If the cortical substance of the kidney is only superficially lacerated there need not be even the smallest drop of blood passed with the urine.

1. Hæmaturia may denote simply *contusion of the kidney.* This, I believe, was proved by two cases, in each of which a boy was run over by a carriage wheel. In each case there were collapse and præcordial pain, as well as pain in the affected loin. In one case there was no difficulty or pain in micturating throughout; in the other the catheter had to be used at first. In each case the urine was mixed with a large quantity of blood; in one the hæmaturia continued for three days, and in the other for four days. In neither case was there any contusion of the surface, or any swelling in the loin. Both patients were well within a fortnight, though slight localised peritonitis occurred in one.

2. Hæmaturia may occur by transudation from the temporarily congested cavity of the kidney, and without any appreciable breach of surface, just as bleeding may occur from the nose or from the vascular lining membrane of any other cavity of the body. Toxic hæmaturia, and the bleeding excited by irritants such as cantharides and turpentine, is unattended by any definite lesion of tissue. It is more than probable,

when hæmaturia follows some muscular strain, that the blood is derived by transudation from suddenly congested vessels in some part or other of the urinary tract, not necessarily from the kidney at all. In some cases after death the interior of the kidney has been filled with blood, though no lesion of the tissues could be discovered. In other cases it is probable that a sudden strain has displaced a small calculus which previously had been encysted within the kidney. Hæmorrhage caused in this manner may be severe and of long continuance.

3. Hæmaturia of a temporary character may be caused by an embolus or thrombus within the kidney, and this may occur at the same time as, or even as a result of, some sudden muscular strain.

4. When hæmaturia is not an all but immediate symptom of an injury, but appears at a later period, *i.e.* a day or two afterwards, it may be the consequence of inflammation extending from the damaged muscular or circumrenal cellular tissue of the loin to the kidney, which has not itself been injured.

5. Simple shaking of the kidney, as in horse exercise, seems in certain individuals always to excite slight hæmaturia. The mere change from one pace to another, as well as the prolonged fatigue of riding, have been known to cause in some men bloody urine accompanied by lumbar pain.

6. The results of shaking of the kidneys are more marked in persons who are afflicted with renal calculus or gravel. Conversely, traumatic lesions of the kidney predispose to the formation of renal calculus or gravel.

Renal hæmaturia of an intermittent character occurs from many causes, from Bright's disease, calculus, and from excess of uric acid in urine.

When the kidney has been *contused* or deeply lacerated, the quantity of blood passed with the urine

during the first few hours sometimes amounts to many ounces; as a rule there is a small quantity at least during the first few acts of micturition. In some cases blood may be passed immediately after and during the day of the accident, and then disappear, to recur, perhaps, a few days, or not until fifteen or sixteen days later, on going to stool or making some other strong muscular effort.* Such hæmorrhages may recur two or three times, or more.

M. Gelley † has recorded a striking case of recovery after injury to the right kidney, followed by immediate hæmaturia which lasted five days, and later on by recurrent attacks of hæmaturia. The recurrences happened on the twelfth day after the injury and lasted nine days; and on the twenty-ninth day, and lasted three days. The patient was a man, aged 62, who was injured by the wheel of a passing carriage.

In other cases the hæmaturia may be slight at first, and increase exceedingly later on. Mr. Reeves has published‡ the case of a lad, æt. 19, who fell from a cart and sustained a very severe contusion of the right kidney. For nine days there was only very slight hæmaturia, but on the tenth and three succeeding days large quantities of nearly pure blood were discharged. The patient died at the end of the fourth week, and at the autopsy most of the right kidney was a broken down pulp, situated in a large retro-peritoneal space filled with blood and blood clot. There was a false aneurysm of a branch of the renal artery. The bladder was distended with blood clot and much inflamed.

In other cases the appearance of blood with the urine has been delayed altogether until the eleventh

* *See* Guy's Hospital Report, p. 470; 1844.

† *Revue Médicale de l'Est; Annales des Maladies des Oryanes Génito-Urinaires.*

‡ *Lancet*, October 4th, 1884.

day (Rayer). In complete rupture, when the kidney is divided into two parts, blood is frequently absent from the urine.* It is also quite certain that the cortical substance may be severely contused, even lacerated, in one or more places without the urine being charged with any blood whatever. Erichsen† records two cases, in neither of which was there any blood in the urine.

Rayer states that hæmaturia, more or less considerable, indicates without doubt that the kidney has been shaken or otherwise injured, either in consequence of a general shaking of the body; or in a violent effort during which the muscles of the parietes of the abdomen were suddenly and forcibly contracted; or in consequence of a contusion of the lumbar region. But he thinks it is impossible to say, in the majority of cases, what is the precise nature of the renal injury.

It is unnecessary to attach great importance to this uncertainty of diagnosis between the several subparietal lesions of the kidney, viz. *contusion*, *laceration*, and *rupture*, except from the point of view of prognosis. The contusions and superficial lacerations are very susceptible of recovery, whereas complete ruptures are almost certain to cause death from hæmorrhage or peritonitis.

The earliest symptom in many cases of subparietal injury of the kidney is pain in the loin or renal area of the abdomen, shooting down perhaps to the testicle, groin, or thigh. In a case‡ of injured kidney, owing to a severe contusion of the left side of the abdomen from a fragment of shell, "the shock was great and of long continuance; there was a bruise in the left flank and excessive tenderness, anuria, and pain, and retraction of the left testicle." In another case, § which

* *See* cases quoted above from Guy's Reports.

† "Science and Art of Surgery," vol. i., p. 850. 8th ed.

‡ "Med. and Surg. Hist. of American War of Rebellion," vol. ii., p. 20.

§ Ibid., p. 21.

recovered, the injury was caused by a fragment of shell; there was pain along the ureter, retraction of testicle, smarting at the orifice of the urethra, difficulty in micturition, and occasionally tubular clots of blood in the urine. The hæmaturia continued for three weeks after the injury, and then the patient gradually convalesced.

If the laceration is a severe one, or if complete rupture has occurred, hæmorrhage into the subperitoneal tissue or into the peritoneal cavity will in all probability be great, and then faintness, collapse, pallor, coldness of the extremities, intense anxiety, thirst, cold sweats, and increased pain in the abdomen will be caused. In the urine, which may either be passed off voluntarily or retained in the bladder till withdrawn by catheter, there may be blood, blood clots, blood casts, and even broken renal tubules.

Mr. Bryant speaks of notes of some half-dozen cases in which, after injury to kidney, clots of the form of the ureter were passed in the urine. Mr. Harrison* has published the case of a man, aged forty-two, who injured his kidney by falling down the hold of a steamship on to the edge of a case of goods. There was much collapse and considerable contusion of the right loin, followed by hæmaturia and the discharge of blood clots with the urine; and on the day following the injury the urine contained some long worm-like casts, which were clots that had been moulded in the ureter. These were not present after the third day. Microscopic blood casts of the uriniferous tubes were occasionally found. The patient gradually improved, but for three weeks there were traces of blood in the urine. A case is reported in the "History of the American War of Rebellion," of hæmaturia persisting for three weeks, and clots

* "Lectures on the Surgical Disorders of the Urinary Organs," p. 333.

moulded to the form of the ureter being occasionally passed in the urine. The urine remained albuminous up to death, two months after the injury.

Sometimes, after intense and urgent pain in the abdomen, the next symptom is frequent and painful micturition, the urine voided being highly mixed with blood. In other cases there is no blood in the urine, or there may be entire suppression of urine. The absence of blood in the urine, with a marked diminution in the quantity of urine secreted, is suggestive of plugging of the ureter with blood clot.

When the ureter is plugged there may be severe renal colic; but this is more likely to occur when comparatively small clots are passing along the ureter to the bladder, than when a large coagulum fills the pelvis or completely stops the upper end of the ureter. Sometimes the bladder becomes distended with coagulated blood, and great suffering is in consequence experienced in the form of frequent straining acts at micturition, attended by intense pain in the hypogastrium and all along the penis, and violent perspirations.

The entire suppression of urine indicates injury to both kidneys, attended with plugging of the renal vessels; or impaction of blood clot in the urethra or neck of the bladder; or it may be due to an inhibiting nervous influence, such as occasionally seems to arise after severe operations,* or to the collapse produced by the injury, or to the general failure of function which may precede death.

Swelling in the belly in certain instances has come on rapidly, and been attended with fluctuation.

There is not usually any ecchymosis of the loin or renal area of the front of the abdomen, though sometimes, when the injury has been caused by the kick of a horse or the transit of a carriage wheel, some

* Dickinson, "Renal and Urinary Affections," vol. iii., p. 1299.

bruising of the surface may co-exist with, but be quite independent of, the extravasation of blood from the torn kidney.

After the effect of shock or loss of blood has passed off, the local pain may continue, and be increased by deep inspiration; the pulse will perhaps become sharp and rapid, the skin hot and feverish, the tongue furred, and nausea and vomiting may arise.

If the injury has been inflicted from the front of the body (and if death does not proceed, as it may do, rapidly from loss of blood), tympanitis, abdominal pain and tenderness, and other signs of traumatic peritonitis may set in.

When the case is going to terminate favourably, the urine, which shortly after the accident appeared perhaps to be almost pure florid blood, may within two or three days entirely clear, first in colour, and then by degrees of every trace of albumen; the pain may become less and less; the pulse decline from 160 beats or more to 80 or less; nausea and vomiting will cease; the bowels will act naturally, and the patient slowly or even rapidly may return to usual health.

In some cases after the hæmaturia ceases the urine may continue to be albuminous for a long time.

In certain cases, presumably of contused if not slightly lacerated kidney, the whole of the above phases have been passed through in the course of a week or ten days.*

In other cases inflammation occurs in the kidney, and the urine then becomes mixed with mucus, renal epithelium, or pus; and the cure may be effected only after the lapse of many months.

After the first onset of the symptoms, which are those of intense localised pain, and possibly of collapse

* *See* cases by Lewis, Campbell, Harrison, of Liverpool ("Lectures on Diseases of the Urinary Organs," p. 333); St. George's Hospital Records, and others referred to in the text.

with loss of blood, there are five chief dangers to anticipate: (1) continuous and excessive extravasation of blood leading to death by syncopy within a few hours or a day or two; (2) peritonitis either as the direct effect of the violence, or of the tension and ulceration of the peritoneum due to the accumulation of blood and urine which has been extravasated behind the peritoneum; (3) inflammation and suppuration of the perinephric tissue; and (4) occlusion of the ureter by blood clot, and the retention of urine within the cavity of the kidney, and its attendant effects of hydro-nephrosis, pyo-nephrosis, pyelo-nephritis, or renal abscess; (5) simple traumatic nephritis.

When injury to the kidney is associated with other visceral lesions, such as rupture of the liver, spleen, lungs, or heart, or with fracture of the skull, spine, or pelvis, the symptoms may be so serious, complicated, and rapidly fatal, as to mask all signs suggestive of rupture of the kidney, unless it be the presence of blood in the urine.

When there is an absence of blood in the urine, injury to the kidney must nevertheless be suspected if there is pain in the renal region, together with collapse or the appearances of internal hæmorrhage. There will, too, sometimes be fulness and dulness of the injured loin, and the abdominal muscles on the affected side will be rigidly contracted and hard. Unless the pelvis of the kidney is torn, there will be no great amount of urinary extravasation. It would appear from certain cases of nephro-lithotomy, as well as from other operations on and lacerations of the kidney, that the torn surfaces of the kidney do not secrete any urine, and that for any considerable urinary extravasation to occur it is necessary to have a wound communicating directly or indirectly with the pelvis of the kidney. Sir Spencer Wells* has

* *British Medical Journal*, April 19, 1884.

published an extraordinary case which tends to support this view. It was one in which he had successfully removed two solid circumrenal tumours, one from around the right and the other from around the left kidney of a lady. The tumours were fibro-lipomata, and they had originated in the connective tissue, not in the pelvis or capsule of the kidneys. The left one occupied a large deep cavity in the loin and pelvis, and, like the right, was easily turned out from a loose membranous capsule. Attached to the left tumour was a piece amounting to one-third of the left kidney. In answer to enquiries as to whether there was any extravasation of urine into the peritoneal cavity or retro-peritoneal cellular tissue from the torn kidney left behind in the body, and whether any provision against such was made by a drainage tube in the abdomen, or an incision through the loin, Sir Spencer Wells kindly replied: "You have exactly hit upon the wonderful points of the case. In reply to your questions (1) two-thirds of the left kidney were left behind in the loin, no urinary infiltration took place; (2) the only provision made at the time of the operation against leakage was the careful apposition (but without suture) of the divided peritoneal covering of the kidney which had been distended into a large capsular cyst-like sheath. Of course, I expected bloody urine and a variety of trouble, but nothing at all occurred to cause any anxiety. Indeed, the progress after operation was exactly like an ordinary ovariotomy." In this case, either no urine escaped from the wounded surface of the kidney, or what escaped was harmlessly absorbed. Sir Spencer Wells adds, "I suppose if such an accident were to occur again, it would be safer practice to excise the remainder of the kidney and tie the ureter." But from this remarkable case, and several recorded instances of injured kidney, it

may be fairly questioned whether the removal of even a greater part of the kidney than one-third may not be effected without fear of urinary extravasation, provided the renal pelvis is left intact.

Prognosis.—That even deep lacerations and severe contusions are not necessarily fatal, is admirably shown by the specimen in St. George's Hospital museum; a firm fibroid cicatrix is seen at the upper part of the right kidney, to which the capsule is adherent. The kidney is otherwise healthy. The accident was a kick from a horse, two years before death from enteric fever, and was followed by all the symptoms of rupture of the kidney.

In the pathological cabinet of the New York Hospital is a specimen which shows the repair of a rupture of the kidney, that almost completely divided the organ horizontally near the centre; "lymph is copiously effused between the separated surfaces and upon the exterior."

Recovery may even follow laceration of the kidney and obliteration of the corresponding ureter. Such a case has been above referred to, and is recorded in the London Pathological Society's Transactions,* the patient subsequently dying of granular disorganisation of the other kidney.

A fatal result may be brought about by collapse, hæmorrhage, or peritonitis, or at a later date by pyæmia, cystitis, hectic fever, or exhaustion from abscesses excited by urinary extravasation, or by broken-down tissues, or blood clot; or death may occur from peritonitis or collapse, set up by the bursting of the contents into the peritoneal cavity, through a sloughing of the limiting membrane of the abscess. If the ureter become permanently obliterated after injury, the kidney becomes destroyed, and death may be caused by suppuration of the organ.

* Trans. Path. Soc. Lond., vol. xi., p. 140.

Injuries of the kidney, or its pelvis, are likely to be complicated with injury to the peritoneum, or to be themselves complications of various kinds of fractures of the adjacent vertebræ or ribs. When the liver or spleen is ruptured as well as the kidney, the prognosis is very unfavourable.

When the injury is limited to one kidney, and death occurs within a few days, the cause of death is usually collapse from hæmorrhage; but in by far the larger number of rapidly fatal cases there are lesions of the viscera besides. Thus, of the twelve fatal cases on my list there were ten in which the liver was ruptured, and in some of these the spleen or lungs, or both, were ruptured as well. In one case there was rupture of the heart and fractured ribs, with partial rupture (deep laceration) of the left kidney. Usually in the fatal cases death occurs from shock or syncope within a period varying from an hour or less to twenty-four or thirty-six hours. When life is prolonged beyond two or three days death may occur in a week from pleuro-pneumonia if the ribs are fractured and the lungs contused. This was the cause of death on the fourth day in one of my cases; and on the second day in one of the cases recorded in St. George's Hospital catalogue. In a case under the care of Mr. Erichsen, pneumonia was the cause of death nine weeks after laceration of the left kidney by a buffer injury. Experience shows the necessity of being guarded in our prognosis, because some cases which at the outset looked very serious, and even alarming, have quickly recovered; whereas others, apparently far less serious, have terminated almost suddenly in death.

In rupture of the kidney, its pelvis, or ureter, the prognosis is less unfavourable than in rupture of the other abdominal organs. There are many cases published of recovery after injury, in which *there is*

reason to believe that the kidney has been lacerated;* and others in which it has been *positively ascertained* that healing had taken place prior to death from other causes.

The proof of the cicatrisation of wounds of the kidney is found in persons who have lived for some weeks, or longer, after laceration of the organ, and have died from some other cause. Such was the case reported by Athol Johnson,† of a man, aged thirty-eight, who ruptured his liver and right kidney, and fractured his seventh cervical vertebra. He died from the effects of the injury to the spine three weeks after the accident, and at the post-mortem examination there were found, besides an extensive rupture of the right lobe of the liver, several ruptures, all beautifully united on the anterior surface of the right kidney.

Lacerations affecting only the cortical substance are often healed by the effusion into them of coagulable lymph or by the organisation of blood clot, which temporarily checks the further extravasation of blood and of urine, and ultimately forms the cicatrix.

It is largely due to the plugging of the renal blood-vessels, and to the capacity of the other kidney, if healthy, for doing compensatory work, that so many recoveries from contusion, laceration, rupture, and puncture of the kidney take place; but the two chief conditions upon which recovery depends are, the escape of the peritoneum, and of the large branches of the renal artery and vein. If a large branch of the renal artery be torn, and death does

* Dr. M. Campbell; *British Medical Journal*, p. 225; Feb. 2, 1884. W. B. Lewis's case of ruptured kidney, recovery; *Med. Times and Gazette*, p. 228, Aug. 20, 1870. Harrison, of Liverpool, *op. cit.*, p. 333. "Medical and Surgical History of the American War of the Rebellion," vol. ii., p. 20.

† Med.-Chir. Trans., vol. xxxv., p. 55.

not quickly follow from bleeding, the gradually increasing hæmorrhage is likely to lead by pressure to sloughing of the peritoneum, even though that membrane may have escaped the original injury.

Diagnosis.—It is more than probable that some of the cases which have been regarded as examples of recovery from ruptured kidney were not really cases of rupture. For example, a lad, aged fifteen years, had been run over, and for three days suffered pain in the hypochondrium, and vomited at intervals. There was blood in the urine on and after the day of the accident, and on the fifth day a quantity of granular matter with uric acid crystals, a little blood, and some casts, were voided in the urine. On the seventh day the urine was clear, and on the tenth the boy seemed well and continued so afterwards. In this case, though the organ was in all probability contused, one cannot but suppose that recovery would have been less rapid if the kidney had been ruptured. In some cases of hæmaturia after a blow on the abdomen, the injury was probably a contusion of the bladder, not a lesion of the kidney at all.

After injury to the kidney or ureter, the symptoms are sometimes too obscure or insufficient for accurate diagnosis. When there is no hæmaturia it is impossible, at first, to say whether the pains in the loin are due to injury to the muscles, to extravasation of blood in the circumrenal tissues, or to a lesion of the kidney itself. If a very acute pain is felt in the loin, without any noticeable alteration in the composition and quantity of the urine, there is a strong probability that the injury is not of the kidney. This, however, cannot always be relied upon. In Stanley's two cases,* the urine was passed naturally and freely, and there were no symptoms leading to a suspicion of injury to either ureter or kidney, until a large tumour,

* Med.-Chir. Trans., vol. xxvii.

from which fluid containing urea was drawn away, formed in the right hypochondrium of one, and in the lumbar region of the other. In Poland's valuable case,* which I had the opportunity of watching when house surgeon at Guy's Hospital, the precise nature of the injury remained doubtful up to the time of death, owing to the almost entire absence of urine during the six days the patient lived. The absence of urine was due to thrombosis of the renal vessels of one kidney, and the rupture of the pelvis of, and extravasation of urine from, the other kidney. Thrombosis of the renal vessels, as a result of violence to the lumbar region of the spinal column, is a possible occurrence, and should be remembered in relation to renal injuries, and to suppression of urine after injury to the back. Dr. Moxon† has described a typical sample of nearly complete obstruction of the vessels of both kidneys, in a man, aged twenty-two, who was struck in the back by an engine.

If, when the collapse from an abdominal injury has passed off, pain in the hypochondriac or lumbar region continues, and there is vomiting and anxiety of countenance; if, moreover, the urine contains blood and blood casts, gradually diminishing in quantity during three or four or six or seven days, or longer; and if convalescence is slow, the suspicion that some contusion or laceration has occurred is justly aroused.

If after the abdomen has been run over, or the patient has fallen or been struck on the abdomen or loin, faintness, coldness, vomiting, and abdominal pain follow; if on the day of, or the day after the accident, and whether the catheter be required or not, the urine is found to contain a quantity of blood and blood clot; and if after several days blood clots continue to pass,

* Guy's Hospital Reports, 3rd series, vol. xiv.
† Ibid.

or pus as well as blood is voided in the urine; if, moreover, there is pain along the course of the ureter, with retraction of the testis, or a rigid and prominent state of some of the muscles of one side of the abdomen, with frequent desire to micturate; or, finally, if a tumour, dull on percussion, forms in the loin or lumbar or hypochondriac region of the abdomen, accompanied or not with signs of local peritonitis, there are safe grounds for believing that either the kidney or its pelvis has been ruptured. The passage of blood clot along the ureter into the bladder is a source sometimes of great suffering, and of cystitis. The clots frequently assume the shape of the pelvis of the kidney; sometimes they are long, worm-like casts which have been moulded in the ureter, and sometimes they are blood casts of the uriniferous tubes. The latter are frequently seen, if looked for, after slight injuries such as contusions of the kidneys. If the bleeding is not excessive, these various clots cease to pass after a few days.

A typical and instructive case, the notes of which I took when dresser to the late Mr. Hilton, was made the subject of a valuable clinical lecture* by that philosophic surgeon:

The case was that of a man, aged twenty-one years, who had been struck by the buffer of an engine. On admission he vomited, and complained of great pain in the abdomen just beneath the ribs, which was aggravated on the slightest pressure; the next morning vomiting and pain continued, but he was able to walk to the closet where he passed both urine and fæces. On the day following the injury the catheter had to be passed, and a pint and a half of bloody urine was withdrawn. Some improvement followed on the fourth and fifth days, but on the eighth there was an increased quantity of blood in the urine. From the fourteenth

* Guy's Hospital Reports, 3rd series, vol. xiii., p. 9.

day till his death clots of blood accumulated in the bladder and, besides obstructing the flow of urine, gave rise to agonising pain in the hypogastrium and at the end of the penis. The pain in the penis was much relieved at times by merely passing a catheter a few inches down the urethra. A dull swelling formed in the left side of the abdomen; tympanites and delirium supervened; and the patient died on the twenty-sixth day. The left kidney was found ruptured across the middle, and the lower segment cracked transversely by numerous minute fissures. The left ureter, and a branch of the left renal artery, on which was a small recent aneurism, opened into a large cavity surrounding the broken kidney, and filled with grumous and vilely offensive blood clot and urine. The renal vein was not injured. In the peritoneum, forming the anterior wall of this cavity, there was a ragged rent in a thin slough, through which offensive bloody serum was found to exude into the peritoneal sac. No positive evidence of peritonitis existed.

Mr. Cock has recorded * a case of rupture of a *single* kidney, in a lad eighteen years old, who fell from a height on to some rafters. The patient died comatose on the eleventh day. The left kidney was completely divided through its pelvis, and the two halves were widely separated by a large collection of blood and urine, which had been extravasated very widely into the cellular tissue behind the peritoneum. The kidney and ureter were nearly twice the normal size, owing to the rudimental state of the right kidney. There was congenital absence of the upper part of the right ureter, vein, and artery.

In other cases referred to in this chapter there were dulness and swelling in the lumbar and iliac regions, caused by the extravasation of blood when the kidney was completely ruptured, and by the effusion of blood

* Trans. Path. Soc. Lond., vol. i., p. 293.

and urine when the pelvis of the kidney was torn. It is sometimes difficult to diagnose such swellings from tumours due to **distension of the cavity of the kidney with blood clot.** Rayer* has recorded a case of this latter sort, and has made remarks on it to the following effect:

Hæmaturia, more or less considerable, is the most constant result of contusions of the kidney; but it is excessively rare that blood after being coagulated in the ureter or pelvis of the kidney is accumulated more and more in such a manner as to distend the kidney and to transform it into a large sac which extends from the hypochondrium to the iliac fossa. Renal tumours of this dimension are ordinarily the consequence of pyelitis, of a hydro-nephrosis, or of a cancerous, tubercular, cystic, or hydatid degeneration. One can recognise, or at least suspect, that the distension of the kidney is a sequence of an internal hæmorrhage by the nature of the case, and the rapidity of the development of the tumour. Undoubtedly it will be difficult to distinguish during life a tumour formed by an extravasation of blood around the kidney and outside the peritoneum, from a tumour caused by the dilatation of the kidney by blood accumulated within its cavity. Yet, in extrarenal hæmorrhages the tumour generally appears soon after the accident, and is not circumscribed like renal tumours. A tumour due to blood effused within the cavity of the renal pelvis is formed later, and more slowly, than an infiltration of blood into the subserous cellular tissue, as the kidney is distended with more difficulty than the peritoneum can be detached from its connections.

The case itself was communicated by M. Danyan.

A young workman, aged fifteen, was taken to the Hotel Dieu, in the early part of October, 1835; the

* "Traité des Maladies des Reins," vol. i., p. 280.

anterior region of the left kidney had been contused against a counter; after this he passed blood with his urine. Some time afterwards, the hæmaturia for a while having ceased, he suddenly voided from three to four "palettes" of pure and bright blood. On the 19th of November a remittent tumour was felt in the hypogastrium and left flank, and seemed to be elongated in the direction of the ureter. The bladder contained clots of blood; there was retention of urine, and catheterism was very painful; and the tumour, without becoming more painful, was more prominent and larger. He died on the 26th of November. At the post-mortem the tumour consisted of the kidney, its pelvis, and the commencement of the ureter greatly distended and filled with a mass of black coagulum which had already commenced to decompose. There was no trace of either pyramidal or cortical substance of the kidney left; they had both disappeared as the result of intrarenal pressure caused by the effused blood. On examining the interior of the sac with care, the orifice of a renal artery, plugged by a clot, was discovered. The walls of the tumour were formed by the fibrous tunic of the kidney and the condensed layers of the surrounding cellular tissue. The lower end of the left ureter, and the kidney and ureter of the right side, were healthy; the bladder was healthy, and moderately distended with clear urine.

Rupture of the ureter.*—There is no occasion to consider this apart from rupture of the kidney, as in the few cases on record the rupture was quite close to the renal pelvis. This is only what might be expected, since the ureter is so placed as to be well nigh secure from all external violence. Moreover, it is neither practicable nor necessary to make a distinction between the two sets of cases, either as regards

* For account of wounds of the ureter *see* page 176.

symptoms or treatment. Poland has put together six cases of so-called injury of the ureter;* two of them were bullet wounds, not subparietal ruptures; two were cases recorded by Mr. Stanley, and two were Guy's Hospital cases, one of which had been published by Mr. Hilton, and the other had been under the care of Mr. Poland. In one of the gun-shot cases the ureter was injured near to the pelvis of the kidney. The other case was described by Hennen as a "complicated wound of the kidney." Poland's own case is the only one of the six in which there was a rupture of the ureter, as distinct from the pelvis of the kidney; it is, so far as I am aware, the only known case in which a subparietal rupture of the ureter has been proved, and even in this case the injury to the ureter was complicated by a rent in the kidney substance. R. Harrison† briefly records a case of "rupture of the ureter close to the left kidney," that is, of the pelvis of the kidney; and cases of torn pelvis have been reported by Mr. Bennett May and Mr. A. E. Barker, and will be referred to under treatment of such cases.

Treatment.—In all cases in which contusion or rupture of the kidney is suspected or known to have occurred, absolute rest in bed must be observed; stimulants and solid food must be avoided, and pain and restlessness must be allayed by the subcutaneous injection of anodynes. The internal use of gallic acid, infusion of matico, ergot of rye, and the preparation of iron have been recommended to check hæmorrhage, and should be tried; acetate of lead, combined with opium, has been employed for the same purpose. The liquid extract of ergot in drachm doses every two hours until four doses have been taken, or in half-drachm doses every three hours, and repeated

* Guy's Hospital Reports, third series, vol. xiv.

† "Lectures on the Surgical Disorders of the Urinary Organs," p. 328.

as long as circumstances require it, is, I consider, the most certain and most rapidly efficacious remedy of this sort; or three grains of ergotin may be subcutaneously injected, instead of giving the liquid extract by mouth. Thirst should be slaked and sickness checked by sucking ice. Ice given by the mouth assists in lowering the temperature of internal parts and thereby in checking internal hæmorrhage.

Pain will be sometimes assuaged by strapping the affected side; a practice which assists in keeping all the parts about the injured organ quiet, and which by gentle compression tends to limit and check hæmorrhage. If the large bowels be full of solid fæcal matter they must be relieved by enemata of oil and water, otherwise they ought not to be disturbed for several days. I have seen sharp hæmaturia from an injured kidney brought on unexpectedly more than a fortnight after the infliction of the wound, and when the patient appeared to be quite convalescent, by the passage of hardened fæcal matter along the colon, and thus across the surface of the kidney. This occurred in a case of nephro-lithotomy in a young man, which I reported to the Clinical Society in 1885. To assist in keeping the intestines free of fæcal matter until sound healing has occurred, only fluids, and those only in small quantities at a time, should be allowed for two or three weeks at least. It is especially important that the quantity of fluids should be limited as far as possible, because they tend to increase the activity of the kidneys, and this, under the circumstances, is very disadvantageous.

In cases of injured kidney of every description the diet must be bland in character, fluid in kind, and limited in quantity.

In Hilton's case, to which I have already referred, the patient, at his own earnest request, was allowed a little solid food on the eighth day after the accident,

and from that time fresh hæmorrhage ensued, and the case went rapidly from bad to worse. To quote Mr. Hilton's own words, "Up to this time the case seemed to promise a good result. The blood in the urine was daily diminishing; the vomiting, pain, and other general symptoms were abating in severity. On the seventh day he had a craving for solid food; this was allowed him, and from the period that his diet was improved he retrograded. His urine again became more bloody. The solid food was, of course, at once discontinued; but it had already induced some mischief. It necessarily produced an increase of the vermicular motion in the intestines, and also caused the heart to pulsate more forcibly; and now that we are familiar with the post-mortem evidence we can see how an increased force of the circulation might, and probably did, dislocate a clot which was closing the mouth of a torn artery."

Every precaution should be taken against exciting irritability of the stomach; and if vomiting occurs the patient should be fed entirely by nutritive enemata. Fresh hæmorrhage is apt to be excited by the detachment of clots, and the reopening of plugged vessels by straining efforts. Vomiting, therefore, as well as defæcation and the peristaltic action of the intestines, are to be prevented if possible. In all abdominal injuries in which hæmorrhage is to be feared, intestinal and gastric activity is undesirable, and therefore solid food and aperients of every sort are to be forbidden; solid food has a twofold objection, it stimulates the action of the heart, and also the involuntary muscular fibres of the viscera.

When there is reason for thinking that hæmorrhage is going on, either from the profound or continued collapse of the patient; the quantity of blood voided by the urethra; the diffused dulness and

swelling of the loin and renal region of the abdomen, which indicate extravasation into the retro-peritoneal cellular tissue; or from the formation of a circumscribed renal swelling, which is the mark of hæmorrhage into the cavity of the kidney itself; ice bags, or Leiter's tubes through which a stream of iced water is kept running, should be applied to the loin and ilio-costal area of the abdomen. The ice, or iced water, may be applied with advantage outside the strips of strapping, which should reach from the spine to the linea alba.

When arterial blood escapes into the pelvis of the kidney, it traverses the urinary passages rapidly, and is quickly expelled by the bladder, which is excited to frequent spasmodic contractions to expel it; and if this form of hæmorrhage continues, and threatens the life of the patient, despite all the efforts which have been mentioned to check it, an exploratory incision into the loin, followed (if the extent of injury to the kidney indicates it, or the hæmorrhage cannot be checked without it) by nephrectomy, should be resorted to. If clots of blood accumulate in the bladder, or are forced into the urethra, and there give rise to such pain and distress as was suffered by Mr. Hilton's patient, median urethrotomy or lateral prostatotomy should be performed. The bladder would readily be emptied of clots through such a wound in the perineum, and could be kept aseptic by making the patient lie on well-made pads of German moss-peat, and by covering the wound lightly by iodoform cotton-wool, through which the urine would percolate. I well remember the question of cystotomy being discussed in the case referred to, and feel sure that it would have saved much suffering had it been performed.

Mr. Rawdon,* of Liverpool, has put on record a case in which he adopted this treatment, but

* *Brit. Med. Journal*; and *Lancet*, May 26th, 1883.

unfortunately at too late a period. His patient was a boy, aged twelve years, who was admitted into the Liverpool Infirmary on the day after he had fallen into a stone basement, a height of about eight feet. He was passing blood in his urine, and suffering pain in the right side, and there was a small bruise over the crest of the ilium. For the first few days the hæmaturia diminished, but it subsequently increased and acute cystitis followed. The diagnosis was rupture of the right kidney: and with the object of preventing blood from entering the bladder, the injured kidney was removed by lumbar nephrectomy on the seventeenth day. The kidney was found to have been torn nearly completely across. Relief followed the operation, but acute cystitis continuing, lateral cystotomy was performed four days after the nephrectomy, and on the twenty-first day after the injury. Fœtid clots were removed from the bladder through the wound. Relief from the bladder symptoms was obtained, but death followed on the fortieth day after the injury from pyelitis and suppuration of the substance of the left kidney, due probably to extension upwards from the bladder of the inflammation which had been excited by the presence of decomposing blood clots there, and by the retention of urine to which they had given rise.

When the blood clots are of small size, and the hæmorrhage less considerable, no instruments are required, or should be used, for their removal; they will be voided through the urethra without undergoing decomposition or setting up vesical inflammation. The urine itself has a solvent effect upon the clots, and this will suffice to get rid of even a considerable amount of blood. But when the blood clot leads to retention of urine, associated with spasmodic contractions of the bladder, a full-sized catheter with two large eyes must be introduced, and the bladder

injected with some antiseptic solution, so as to break up the clot and assist its removal. And if the instrument enters a large mass of coagulum and little or nothing escapes through the catheter, Clover's or Bigelow's lithotrity aspirator should be tried. The error of injecting styptics into the bladder should not be committed.

Failing by these methods, the last resource will be urethrotomy or cystotomy. Although it is needless to say that such an operation should not be contemplated except in obstinate and severe cases, yet where the bladder is more or less distended with blood, and frequent, fruitless, and painful efforts at micturition torment the patient, it is well to bear in mind that a much better prospect of recovery will be afforded by not postponing the operation until the patient is exhausted by hæmorrhage or spasms of the bladder; or until cystitis has been set up, and the clots within the bladder have decomposed, thereby exposing the patient to the risks of suppurative pyelo-nephritis.

I think it is not too sanguine to hope that, in the future, lives may be saved by the timely and well-judged application of lumbar nephrectomy and urethrotomy. Nephrectomy should be entertained in cases of profuse and continuous hæmaturia, especially if the bleeding is rapid and arterial; and also in cases in which, though hæmaturia may be slight or altogether wanting, there is a strong presumption, from the increasing collapse, pallor, and dulness and swelling of the loin, that the kidney has been severely injured. In such cases an exploratory incision should be made down upon the kidney through the loin, and it will be more than probable that, just as in Mr. Rawdon's and Mr. Hilton's cases, the kidney will be found in great part or entirely torn across.

When the abdomen has become distended, but without being entirely tympanitic, a course of calomel and

opium has been adopted as the treatment, under the idea that the injury has set up traumatic peritonitis. In certain cases the result has been satisfactory.* But, as Athol Johnson long ago pointed out, the distended state of the belly and the pain which is usually so much complained of in the first instance, is not inflammatory, but is due rather to the stretching of the peritoneum, largely supplied as it is with nerves from the sympathetic system. If, however, traumatic peritonitis should be excited, and there has not been much loss of blood, it must be treated in the early stages by the application of twenty or thirty leeches followed by cold compresses, flannels wrung out of iced cold water, or Leiter's tubes, to the abdomen. In the later stages, cold applications and leeches are out of the question, and hot fomentations applied over conium, belladonna, or opium ointment, or turpentine stupes, should be substituted. At a still later period, blisters, iodine applications, or mercurial preparations are sometimes useful in promoting the absorption of inflammatory products. Opium is the sheet anchor in these cases, and should be given in half or one-grain doses every three or four hours to an adult. In young subjects, and where the peritonitis is of the sthenic form, calomel in one grain doses, combined with opium, should be given until the system is brought under its influence; in some cases it affords great relief from meteorism.

Constipation should be left untreated for some days; enemata are the best means of affording relief. The same great care should be employed with regard to diet as is requisite in all forms of peritonitis, so as to avoid any undue action of the intestinal muscular coats and abdominal muscles.

If a renal or perinephric abscess, or pyo-nephrosis, or dilatation of the cavity of the kidney, with urine

* *See* St. George's Hospital Catalogue, series xi., case 4.

and blood clot, follows as a late result of an injury to the kidney, it should be treated on the principles laid down under those headings in other parts of this work.

The late Mr. J. F. West,* of Birmingham, removed by lumbar nephrectomy from a boy, fifteen years old, who received an abdominal injury four months before, a suppurating kidney, which weighed sixteen ounces. Hæmaturia, a lumbar tumour, pus in the urine, and pyrexia, followed the injury. The aspirator was used a month afterwards, and fifty-five ounces of purulent fluid were removed from the interior of the kidney; this operation was repeated a week later, and followed up by lumbar nephrotomy and drainage. As purulent ammoniacal fluid daily passed through the drain tube, and the patient was rapidly emaciating, nephrectomy was performed; but the patient died (as I learn from Mr. Jordan Lloyd) between two and three weeks afterwards from exhaustion and purulent infiltration into the retro-peritoneal connective tissue.

Another case in which aspiration was followed by lumbar incision, and at a still later period by lumbar nephrectomy, has been recorded by Mr. A. E. Barker, in the *Lancet*, January 17th, 1885.

In this case a male child, aged 3 years and 8 months, had been run over by a hansom. It would seem that the pelvis of the kidney had been lacerated by the transit of the cab wheel, and that urine had escaped into the circumrenal tissue, and there formed an encysted collection of urine and pus.

A case very similar in character to the above, which yielded to aspiration and to the treatment of simple perinephritis, had been previously published by Mr. Bennett May, in the *British Medical Journal* (January 20th, 1883). A man, aged twenty-four,

* *Brit. Med. Journal*, p. 669; April 7th, 1883.

had been kicked about the body on the evening of October 1st, 1881. On October 2nd the abdomen was strongly retracted, and there was intense pain in the left loin and hypogastrium. He was straining unsuccessfully to pass water; a catheter drew off twenty ounces of nearly pure blood, and during the day the patient voided fifteen ounces more of a similar fluid. The urine continued deeply blood-stained from the date of injury till October 5th, when it gained its normal appearance, but was slightly ammoniacal and phosphatic. Then followed dulness, fulness, and a board-like hardness of the left flank, but no defined tumour.

The aspirator was used, and seven ounces of bloody urine of ammoniacal odour, identical in characters with what the patient had been voiding just before the cessation of the hæmaturia, were drawn off from the loin. A short time after the aspiration the patient passed naturally a large quantity of blood-stained urine. He steadily improved, the hæmaturia decreased, and finally ceased entirely on October 12th. On the 17th of the month he left the hospital feeling quite well.

Subsequently (January, 1882) this man had an attack of non-suppurative perinephritis of the same side, attended with pain along the branches of the lumbar plexus and flexion on the thigh, from which he recovered completely. (*See* page 200.)

Mr. May's explanation of this case is the reasonable one, namely, that the kicking caused a small rent in the pelvis of the kidney, and that through this urine escaped into the perinephric tissue, and became temporarily encapsuled there. The obstruction to the ureter may have been caused either by blood clot detached by the injurious action of the aperient administered on the fourth day, or by the accumulating pressure of the extravasated urine. In

either case the cessation of the obstruction followed forthwith the withdrawal of the extravasated fluid.

Another case in which aspiration followed by drainage through a large puncture was effectual, is reported by Mr. Marshall.* The patient was a girl, aged thirteen, who was run over by a cart. A large quantity of chocolate-coloured fluid containing urea, and yielding a strong urinous odour, and a heavy albuminous precipitate on heating, escaped through the drain tube. The patient was discharged with a superficial wound, thirteen months after the accident, and about five months after her admission into the hospital.

It is pretty certain that in this as in other cases where urine escapes into the cellular tissue, either the renal pelvis is ruptured or a calyx is laid open, and that the extravasated urine comes from the cavity of the kidney, not from the torn renal substance.

It would seem from Sir Spencer Wells' case quoted above, as well as from numerous instances of lacerated kidney, that the torn renal surface is not capable of secreting urine at all, or, at any rate, not in sufficient quantity to give any of the characters of urine to the fluid contents of a tumour in contact with the kidney.

In Mr. Reeves' case, referred to on page 125, it is to be regretted that a lumbar incision, followed by nephrectomy, was not practised. The contused condition of the kidney, which was reduced to a broken down pulp, rendered recovery impossible; the fulness and tenderness over the right loin, and the severity and continuance of the recurrent hæmaturia, pointed to the advisability of the operation; whilst the age of the patient (nineteen years) was in favour of a good and rapid recovery.

* *Lancet*; and *British Medical Journal*, May 26, 1883; and Roy, Med.-Chir. Trans., vol. lxvi., p. 311.

The following case shows how recovery may sometimes occur spontaneously and in spite of severe hæmaturia and very heroic blood-letting.* A cavalry soldier whilst dressing his horse received a kick in the lumbar region; some time afterwards he fainted, and only recovered after he was carried to his room. Very soon afterwards there was a large ecchymosis at the surface of the part where he was kicked; there was little manifest pain; the respirations were impeded, and the pulse small, hard, and frequent. He was bled immediately. Within four hours from the accident his condition was much worse, the abdomen was tympanitic, tender, and very painful, his respirations were very difficult, fever had commenced, and no urine had been passed. He was bled a second time, and more freely than the first. During the night he was horribly tormented by a desire to urinate, but without capacity to do so. The next morning the bladder was found considerably distended; a catheter was introduced, and a large quantity of urine, at first of natural colour, but quickly becoming bloody, was evacuated. He was at once much relieved; but a quarter of an hour after the use of the catheter he perceived a trickling of blood, which lasted during an entire hour, and procured him much comfort. The fever, pain, and tumour of the abdomen entirely disappeared, the respirations became easy, and two hours afterwards the urine was discharged naturally. Hæmaturia persisted during three consecutive days at intervals more or less prolonged; on the sixth day there only remained a slight pain in the lumbar region. The fifteenth day he was able to walk about, and on the twenty-fifth day he was discharged.

Dr. R. F. Weir † has recently reported a case of

* "Aran. Essai sur l'Hématurie," 1811. Quoted by Rayer, vol. i., p. 278.

† *New York Medical Journal*, Dec. 27, 1884.

injury to the kidney followed by an abscess within the substance of the organ, which was treated successfully by nephrotomy and drainage. A woman, æt. 26, was kicked, and for two days subsequently passed bloody urine; afterwards she had fever with nausea and abdominal pain, and a tumour formed above the right ilium, from which a syringeful of pus was withdrawn by a hypodermic syringe. It was hoped that the abscess was perinephric, but on exploring through an incision in the ilio-costal interspace the kidney itself was found so softened that with a thrust of the finger a cavity was opened, and a quantity of grumous bloody pus was evacuated. Drainage was maintained for many days, and in about six weeks the wound was entirely healed, though some hardness remained at the point which corresponded with what had been the lower part of the tumour.

Mr. Croft* describes a case of supposed traumatic hydro-nephrosis in a boy aged twelve years, who, on June 3rd, 1880, fell and hurt his left side and loin. This case also shows that whether outside or inside the cavity of the kidney, an accumulation of urine in the loin in consequence of an injury may in some cases be entirely and permanently got rid of by the use of the aspirator.

Up to and inclusive of October 15th, *the tumour was tapped eight times.* More than three and less than four pints of much the same fluid were withdrawn each time, except that on the last occasion there was a very large amount of albumen. From this time no swelling existed, and ten months after the boy remained in a "cured" condition. Mr. Croft explains the case by supposing that at the time of the accident a lesion (but not a complete rupture) of the pelvis of the kidney near its junction with the ureter occurred, and that adhesive inflammation, and, as a consequence,

* Clinical Society's Transactions, vol. xiv., p. 107.

complete obliteration of the lumen of the upper end of the ureter followed. The cure was obtained, he thinks, by the entire atrophy of the kidney and the contraction of the hydro-nephrotic cyst.

One of the two well-known cases recorded by Mr. Stanley * may have been (probably was) of the same character as Mr. Croft's. This patient also was a boy, who developed a large swelling in the right side six weeks after an injury. No symptoms of drowsiness or uræmia were observed. Upwards of fifty ounces of urinous fluid were drawn off through a cannula; and at intervals, ranging from eleven days to three months, the tapping was repeated, and the same kind of fluid was withdrawn. At the last tapping only six ounces came away; the tumour slowly diminished, and at the end of nine months the patient left the hospital with a swelling which still fluctuated. The final termination of the case is not known.

CHAPTER XIII.

INJURIES OF THE KIDNEY COMMUNICATING WITH AN OPEN WOUND.

Penetrating wounds of the kidney.—Wounds of the kidney have been described by almost all systematic writers. Celsus pointed out the principal symptoms of injuries to these organs as being "pain extending to the groin and testicle, difficult micturition, and hæmaturia, or the discharge of blood itself along the urethra." A special dissertation on them was published by Gittler † at

* Trans. Med.-Chir. Soc., vol. xxvii.

† Gittlerus, "De renum vulnere, et qui huic succedit, cruento mictu." Leipsic, 1596.

Leipzig, as far back as 1596. Chopart gives a chapter on wounds of the kidney in his "Des Maladies des Voies Urinaires" (Paris, 1791), and cites several instances; four, at least, of recoveries from incised and punctured wounds. A good deal of information on the nature of wounds of the kidney is given by M. Hévin,* in his admirable historical and critical memoir on nephrotomy. Rayer, in his exhaustive classical work, "Traité des Maladies des Reins" (vol. i., 1839), gives excellent general descriptions of the various forms of wounds, contusions, and ruptures of the kidney, as well as brief summaries of the literature of the subject, and the full notes of ten cases of wounds and thirteen cases of contusions and ruptures of the kidney, which he had gathered from the published records up to his time.

Wounds of the kidney in civil practice, at least, are very rare; and in warfare uncomplicated wounds of the kidney are not common. They differ widely from one another, according to the nature of the weapon with which they are inflicted; as to whether they involve the cortex only, or penetrate to the tubular or pelvic portions of the organ; and, again, as to whether they do or do not implicate the peritoneum or large blood-vessels of the kidney. From the anatomical position of the kidney, wounds like subparietal ruptures of this viscus may be of two chief classes: (1) those inflicted upon the posterior surface and in which the peritoneum is not involved; and (2) those affecting the front surface and involving the peritoneum and very probably some of the other viscera as well.

Symptoms.—A wound of the kidney will be indicated by the situation, direction, depth, and immediate consequences of the injury. As a rule

* Mémoires de l'Académie Royale de Chirurgie, tome iii., p. 238; fol. ed. 1819.

it is followed at once by more or less acute pain in the renal region. In most cases the pain is severe; in some it has been described as excruciating; while a few it seems to have been slight, or altogether wanting. Hence Hunter speaks of the "sensation" as being "trifling;" and John Bell says, "The patient will be easy and his belly soft, for some days, till the blood, coagulating, either by the weight of its coagulum or by the acrimony of its serum, excites inflammation; so that on the sixth day there come pain, swelling, hardness of the abdomen, quick pulse, fever; at last the torments of the *miserere mei*, and then gangrene and death . . . If there be pain and swelling on the first or second day it is from wounded intestine; if there be pain and swelling, but not till the sixth day, it is from blood which has begun to excite inflammation; if there be no pain nor swelling till after the fifteenth day, the patient is almost safe." The pain is not confined always to the renal region, but extends frequently along the ureter, to the testicle, and even to the corresponding thigh. Occasionally there is retraction of the testicle, or spasmodic contractions of the scrotum may be noticed.

Another early symptom is the escape of blood, or blood and urine, from the wound when the injury is behind the peritoneum. If the kidney is wounded superficially and the cortical substance alone affected, blood may appear externally; or be poured out into the circumrenal cellular tissue; or escape into the peritoneal cavity if the injury has been inflicted from in front, or the peritoneum has been reached and transfixed from behind. If the wound of the kidney is deep and the calyces or renal pelvis opened, urine as well as blood may escape from the external opening; or be extravasated into the retro-peritoneal tissue, or peritoneal cavity. *Urine is not likely to issue forth unless a calyx or the renal pelvis has been penetrated.*

Hæmaturia may or may not be an early symptom. If the cortex only is wounded, hæmaturia will not necessarily occur at all; when the cavity of the kidney has been opened it is most likely to force itself on the attention very quickly after the patient has been injured, and urine more or less stained with blood, or even pure blood, may be passed freely within a few minutes *per urethram*. On the other hand, dysuria, or urgent and frequent desire to micturate without the ability to do so, may be a leading feature; the discharge of urine along the ureter into the bladder, or along the urethra from the bladder, being prevented or rendered difficult by the impaction of blood clot either in the ureter, the urethra, or at the neck of the bladder.

When hæmaturia occurs, it may set in at any time from a few minutes to a few days, though usually it commences within a few hours; it may last for only a day or two or extend over several days; it may be slight, and sufficient merely to stain the urine, or it may be profuse and rapidly fatal.

In some cases so much blood is effused into the surrounding tissues and peritoneum, and is drawn away from the kidney so rapidly, that none traverses the ureter to the bladder, even though the wound opens the renal cavity. This was proved to have been the case in an instance given by Morgagni.* A man, aged twenty, was stabbed on March 24, 1742, and rapidly died from internal hæmorrhage. The knife had entered the right cavity of the thorax between the ninth and tenth ribs, and after piercing the diaphragm close by these ribs and penetrating the adjacent part of the liver, it passed through the right kidney obliquely from the anterior to the posterior surface and wounded the muscles by the side of the spinal column beyond. No very large

* Morgagni, Letter liii., s. 40.

blood-vessel was wounded, but an enormous quantity of blood was poured out into the peritoneal cavity. *The bladder contained a small quantity of urine unstained by blood.*

To the above symptoms others must be added as occurring shortly after the infliction of a severe wound. Nausea and vomiting, pain in the epigastrium, muscular spasms, and rigidity of the abdominal parietes on the side injured; fainting fits; a small pulse, rapidly becoming feebler, irregular, and more and more rapid; coldness of the skin; restlessness; and intense anxiety of features all indicate considerable shock and more or less loss of blood. If the peritoneum is wounded and urine escapes into its cavity traumatic peritonitis will soon declare itself. If the wound does not involve the peritoneum, peritonitis may come on at a later period by extension of inflammation from the retro-peritoneal cellular tissue. With all these wounds, when not fatal within a few days, inflammation more or less severe and widespread must be looked for; in gun-shot wounds it is inevitable, in clean punctured or incised wounds it may possibly be escaped. During the course of the inflammation there is abdominal distension and pain, a dry hot skin, a parched tongue, red at its edges, and furred in the centre, and a high temperature with a rapid pulse. Rigors sometimes mark the commencement and continuance of suppuration. Should the inflammation involve the kidney itself the symptoms of nephritis or pyelitis will arise; pus in the urine from inflammation of the renal pelvis is frequently noted in gun-shot wounds.

When the inflammation commences in the retro-peritoneal cellular tissue, perinephritis and perinephric abscess present themselves in the various forms and with the several tendencies described under those heads. There may form outside the peritoneum, after

some hours or days, a dull swelling due to the accumulation of blood, or of blood and urine; and at a still later period retro-peritoneal suppuration may give rise to just the same kind of hardness and swelling as extravasated blood or urine. Subsequently in each case the peritoneum may become inflamed owing to its being stretched and irritated; and death from peritonitis in this way occurs. Lidell* gives an instance of gun-shot wound of the right kidney, in which the patient died of peritonitis fifteen days after he was wounded. The right kidney had been pierced by the ball, which was found lying loose in the cellular tissue near the spinal column; the kidney was mostly disintegrated, the bladder highly inflamed and filled with bloody pus, and the peritoneum everywhere inflamed. The ball entered about two inches to the left of the third lumbar vertebra, and passing obliquely forwards, upwards, and to the right, traversed the bodies of the second and third lumbar vertebræ to reach the right kidney.

When the injury to the kidney is associated with wounds of the stomach, liver, spleen, or other important part such as the intestines, diaphragm, or thorax, an almost certain, and generally a very speedy death from shock, or shock and hæmorrhage combined, must be anticipated. When the spinal column is involved symptoms due to that lesion will be present. Thus, in Lidell's case just quoted there was partial paralysis of the lower extremities with diarrhœa and inability to void urine from the first; on the ninth day peritonitis and ischuria renalis, and on the thirteenth complete paralysis of the lower limbs and enuresis in place of retention of urine occurred.

Retention of urine, which has been known to last for four, five, or six days and longer, and then

* Lidell, "Injuries of the Spine;" *Amer. Journ. Med. Sciences*, Oct., 1864; p. 134.

to be followed by the passage of bloody urine and blood clots, has in some cases of punctured wounds been a striking feature.

There is the utmost uncertainty as to whether, after an injury to the kidney, there will be simple retention of urine, or dysuria with frequency of micturition, or retention with frequent painful and fruitless efforts to micturate.

If foreign substances have been carried into the wound and become lodged in the interior of the kidney, much distress and even violent suffering may be caused by the transit of the foreign body along the ureter and urethra.

Portions of clothing carried in by a bullet may possibly be detected and removed through the external wound.

Sometimes as the result of ulceration air may gain admission to the renal pelvis. Sometimes a fragment of bone may either be driven into the kidney by the weapon, or find its way there after a time by pressure or ulceration.

In two gun-shot cases, pieces of cloth from the soldiers' uniforms (in one instance accompanied by epithelial detritus, and in the other coated with phosphates) were passed by the urethra. One of these is mentioned by Demme,* who says, "One of my colleagues at the Ospedale, San Francisco, observed a case of shot wound of the kidney in which a piece of cloth from the soldier's uniform passed by the urethra; examination proved the cloth to be impregnated with epithelial detritus."

The other, probably the most singular case on record, as illustrating nearly the whole series of symptoms of injuries of the kidney, is recorded by Hennen.†

An officer was wounded by a musket-ball, which

* "Med.-Chir. Studien," b. ii., s. 151. 1861.
† *Op. cit.*, pp. 442, *et seq.*

entered close to the interval of the ninth and tenth ribs, about midway between the sternum and spine, and was cut out from near to the point of the transverse process of the lowermost dorsal vertebra, on the day after the receipt of the wound. Within an hour he voided a quantity of bloody urine. He was in extreme pain, which was aggravated by his being moved a distance of three leagues the same night. Soon the pain spread from his wound over his bowels, and delirium set in; he was then bled several times, and blisters were applied to his abdomen. Then followed intense pain in his right shoulder, and the wound in his back nearly mortified from his lying so long, but in seven weeks he was well enough to be sent to England. The journey excited fever, and peritonitis set in again; and a tumour formed in the site of the posterior wound, which was punctured at the end of a fortnight, and six ounces of pus having a urinous smell were discharged. The discharge continued for some time, and another abscess formed lower down, which was punctured in about three weeks, and a large quantity of pus of the same kind escaped. The abscess healed and burst again and again. Pain, emaciation, and frequent micturition, but with actual diminution of the quantity of urine voided, together with the symptoms of renal colic, followed. And then, at the expiration of seven months from the infliction of the wound, he passed *per urethram* something having the shape of a short thick shrimp, which upon examination proved to be a piece of cloth, covered with black grit. After this he rapidly convalesced.

Stromeyer relates the case of a Danish officer who was shot in the right side under the short ribs, and who soon after passed urine through the wound, and had hæmaturia. A concrement of the size of an orange kernel was voided *per urethram* two months after.

When lumbar pain and swelling are accompanied

by fever, and followed by vomiting, abdominal distension, restlessness, anxiety, and hiccup, then there are what John Bell called "the torments of the *miserere mei*," and death is not far off.

Analysis of the symptoms of gun-shot wounds of kidney during the American war.—Of twenty-six cases of reported recovery from wounds of the kidney, during the American war of the rebellion, hæmaturia occurred in fifteen. Various forms of dysuria are referred to, and lumbar pains, muscular rigidity, partial paralysis, and other disabilities are mentioned. Abstracts of fourteen of these cases are published in the "History," and as many of them lived for several years they supply some important information as to symptoms and ultimate results. From such facts concerning these fourteen cases as are supplied, I find that seven had hæmaturia, two pus in the urine, three pain in micturition, two retention of urine, one for ten days the other only until the day after the injury. One had retraction of, and one acute pain in, the testis. Four had paralysis of the muscles of the leg of the same side as the injured kidney, and three had some weakness of the muscles of the spine and were unable to stoop or lift any weight, or were bent and could not straighten the back without pain in the region of the kidney. In one case, in which the wound of the kidney was complicated with wound of the intestine, the patient passed a musket ball, weighing an ounce, with the stool ten days after he was shot; this man was alive ten years afterwards, but was totally disabled by incomplete paralysis of the right side and constant pain in the back and neck, sometimes so severe as to confine him to bed for several days. In another case in which the descending colon, as well as the left kidney, was injured, there was a permanent fæcal fistula; this man was alive nine years after the infliction of the wound.

The editor of the "History" remarks that in a few cases pus and phosphatic deposits in the urine were observed for considerable periods.

In a very remarkable case (513) the ball entered over the outer part of the left clavicle whilst the soldier was stooping, and having passed through the lung it lodged in the region of the left kidney, and was extracted on the tenth day, together with fragments of fractured bone. After the injury, hæmaturia continued eight or ten days. Nearly five months afterwards the urine contained albumen, granular uriniferous tube casts, and blood and pus corpuscles in abundance. This man was alive ten years and a month after receiving the wound, but suffered frequent pain in the shoulder, and his left arm was partially paralysed.

In gun-shot wounds, when hæmaturia comes on six, seven, eight days or later after the injury, it is generally caused by the separation of sloughs. Herein rests a great distinction between gun-shot wounds and incised wounds. The latter may heal rapidly and without suppuration; the gun-shot wounds must be followed by more or less sloughing and suppuration and all the risks to which those processes expose the patient.

Diagnosis.—In some cases the evidence of a wound of the kidney has been full and complete from the first; in others it has only been arrived at after some of the remoter effects of such wounds have had time to show themselves; in others, again, the diagnosis has remained uncertain throughout; and, lastly, in some fatal cases of abdominal wounds the injury to the kidney has only been thought of when actually seen on the post-mortem table.

When urine, or a fluid having a strongly urinous odour, escapes by the external wound, the diagnosis cannot be uncertain. Hæmaturia and pain in the renal region coming on *at once* after a wound in the

loin, are very strong reasons for diagnosing wound of the kidney. If the hæmaturia follows almost immediately after the injury, and especially if there is a considerable quantity of blood voided *per urethram*, the evidence amounts almost to proof. Hæmaturia has been noted in the larger proportion of cases, and is so fairly constant a symptom that it ought to cause suspicion in cases where there is neither dysuria nor escape of urine by the wound, nor any evidence of urinary extravasation.

When traumatic peritonitis occurs, and hæmaturia exists or has existed, attention should be at once directed to the kidney. Lidell * gives a case in support of this teaching.

A man, æt. 29, was shot in the right hypochondriac region just below the margin of the ribs. Pain, tympanitis, and hæmaturia were quickly exhibited. On the following day the hæmaturia continued, but after this it appears to have ceased. On the fifth day the abdominal pain and tympanitis had increased, and blood had been seen in the stools. He died on the thirteenth day from the bursting of a retro-peritoneal abscess into the right pleura. The right kidney had been pierced at its lower end; the bullet was found against the sacrum.

It must be borne in mind, however, that the kidney may be wounded, and its pelvis actually transfixed, without hæmaturia occurring; whilst hæmaturia may follow a wound which does not implicate the kidney.

Probably, did the patient live, some amount of hæmaturia would, sooner or later, be seen in every case in which a calyx or the renal pelvis was entered, provided the ureter did not become blocked by clot or foreign body. As a consequence of traumatic

* *American Journal of Medical Sciences;* "Injuries of the Abdominal Viscera by Firearms;" April, 1867, p. 356.

perinephritis, the loin may be the seat of pain, the kidney may become inflamed, and the urine may be charged with blood; so that pain and hæmaturia conjoined, when coming on *a day or two after a wound* in the renal region, are by no means absolute signs of a wound of the kidney.

The situation, direction, and depth of the wound; a comparison of the wound with the weapon; and the respective attitudes of the patient and of the assailant at the moment when the wound was inflicted, may assist in guiding to a right diagnosis. Taken by themselves, apart from the symptoms, they cannot, however, be relied upon.

A digital exploration of the wound will, in some cases, make the diagnosis quite clear as to whether the kidney is or is not wounded.

To repeat, it may be stated (1) that a wound in the renal region followed by the escape of urine through the wound is conclusive of wound of the kidney; (2) that such a wound quickly followed by the discharge *per urethram* of urine heavily mixed with blood, or of pure blood, is almost conclusive, if not quite so; (3) that such a wound followed by lumbar or abdominal pain and dysuria, or retention of urine, but without hæmaturia, is highly suggestive of a superficial wound of the kidney, or of a deeper wound and the blockage of the ureter; (4) that hæmaturia followed by traumatic peritonitis is strong evidence of an injured kidney.

Pathology.—The lesions which have been found after death in cases of wounded kidney have varied with the length of time the person has lived after being wounded, and with the nature of the weapon whereby the wound has been inflicted. In some of the gun-shot wounds parts of the organ have been torn and carried away by the missile, so that one or other end is wanting; in other cases the bullet has

transfixed the organ, leaving a lacerated hole right through it. Garengeot and Dumont the younger report cases fatal from incised penetrating wounds of the emulgent vein.

When the patient has lived several days, the kidney has been found more or less disintegrated, with merely a semiliquid pulp in the midst of the inflammatory or suppurating changes of perinephritis. The kidney in some cases has been reduced to a mere abscess sac; or part of it has been suppurating, and the rest has had a pale pink colour, and a granular, softened, and flabby consistence.

The renal pelvis is not very unfrequently the seat of active suppurative changes, and may present greenish, sloughy, or ulcerated patches; blood may be mixed with the pus, and the vessels of the mucous membrane may be much distended.

Sometimes the bladder is highly inflamed by extension of the inflammation along the ureter from the pelvis; in Von Brun's case the opposite kidney was the seat of numerous miliary abscesses. Klebs, however, states that in two cases of gun-shot wound fatal on the fourteenth and eighteenth days respectively, no interstitial new formations were found in either kidney.

Several cases in which death has not taken place until a long time after the infliction of the wound have shown clear evidence of perfect cicatrisation.

Jules Luys records a case of unquestionable gun-shot wound of the kidney in a man who died nine years afterwards; a mass of fibrous tissue was found filling the wound in the substance of the kidney.

When wasting or paralysis of the muscles of the spine or lower limb has followed wounds of the kidney (and these sequelæ have been noted in several instances of gun-shot wound) there has been division or laceration of the nerves supplying those muscles.

Complications, such as wounds of the spinal column, diaphragm, and intestines, bring their own results, so that recoveries from wounds of the kidney may be followed by ill consequences due to such complications; but in some of these cases it is fair to presume that the kidney is repaired and performing a large share in excretion.

When the ureter has become permanently blocked by blood clot, foreign body, or adhesive inflammatory changes, the kidney undergoes those pathological changes which are productive of either hydro-nephrosis pyo-nephrosis, or granular degeneration and atrophy.

Death from causes unconnected with the kidney has rendered it possible to prove the complete cicatrisation of gun-shot wounds of the kidney. Thus, in an instance recorded by Legouest,* a kidney, which had been penetrated by a ball from before backwards near its centre, had upon each face a depressed solid fibrous cicatrix, with fibrous rays branching from it. The man (a Russian soldier), at the battle of Inkermann, had sustained two gun-shot wounds, one in the loin and one in the left knee. He died from the consequences of the wound of the knee joint, and thus the repair of the extensive injuries to the kidney was proved in this case.

Professor Socin reports the case of a man who received a shot wound in August, 1870. The patient was alive in March, 1871, but died shortly afterwards, from a cause not stated. After death the shot was found encysted in the kidney.

The length of time required for the repair of a wound of the kidney varies, no doubt, with the character of the wound. Probably some few days pass before repair commences. In the New York Hospital museum is a specimen (749) showing a deep punctured wound of the convex border of the kidney,

* "Chirurgie d'Armée," p. 403. 2e. éd.

not involving the pelvis. The patient died five days after the lesion from other injuries. There had been no attempt at repair.

Prognosis.—"Servari non potest cui renes vulnerati sunt," says Celsus; but this is far too sweeping; for though serious, wounds of the kidney are by no means necessarily mortal. Hennen says: "The slightest reflection on the situation and structure of the kidney, and on its various sympathies, will at once show the desperate nature of wounds inflicted on it, even with all the caution of a curative intention. The instances that I have observed where recovery has been established are very few indeed. If the patient has survived the first hæmorrhage, the fever and peritoneal inflammation with incessant hiccough and vomiting, and sympathy of the diaphragm and stomach, have generally cut him off; and if he has for a time escaped, excruciating pains, profuse suppuration from fistulous sores, hectic, and emaciation, have terminated his existence. Where the cure has been effected, there is reason to think that the ureter has been but slightly bruised, and the body of the kidney itself left untouched."

At the present day, however, we know, from the success that has attended recent surgical operations upon the kidney, that this estimate of the danger of renal wounds is altogether too unfavourable. Moreover, several cases of recovery from accidental wounds are on record. Haller, Bourienne, Borthwick,* Fallopius, Valleriola, Schenckius, Heister, La Motte, Forest, and other old writers, have given instances of recovery from *incised and punctured wounds.*

The following cases of *incised and penetrating wounds* have been reported as ending in recovery. The

* Hennen (*Op. cit.*, p. 425) refers to the cases of these three observers. References to them and to others are given in the "History of the American War of the Rebellion," and by Rayer.

case of a butcher's boy, aged fourteen, is related by Knox, of Edinburgh, and by Schuster.* He had received a stab wound three inches deep, on the right side, immediately below the twelfth rib, three inches from the spine; considerable hæmorrhage followed; urine mixed with blood was passed for three days; on the seventh day slight icteric coloration of the skin; a copious light brown fluid, which proved to be urine, escaped from the wound; recovery in fifty days.

Bourienne† recites a case of bayonet wound in the side, penetrating the kidney; severe pain, vomiting, distension of the abdomen, and convulsive retraction of the testicle, followed; on the second day blood passed *per urethram;* recovery in twenty-four days.

Purmann's case. — A soldier received a stab wound of the left kidney; retention of urine, finally bloody urine, which escaped with great force on the fifth day; complete recovery in six weeks.

Forest's case.—A youth of twenty, stabbed in the right kidney, had retention for six days; after hot fomentations he passed a quantity of bloody urine, with clots, and had a rapid convalescence.

Dupuy's case. —A man stabbed with a sharpened foil in the right lumbar region; had acute pain, and voided nearly pure blood from the urethra; acute circumscribed peritonitis and nephritis followed; he recovered under an energetic antiphlogistic treatment.

Sir A. Cooper mentions having seen a boy who was struck in the back with a penknife, and almost immediately wished to make water; on doing so, he passed a large quantity of blood. Hæmaturia continued for several days, but subsided on his remaining quiet in bed.

* "History of American War of Rebellion," vol. ii., part ii., p. 162.

† Bourienne, *Journal de Med.-Chir. Phar.*, etc., Juillet à Decembre, 1774; vol. i., part xlii.

Mr. Ackerly,* of Liverpool, relates the case of a man, aged thirty, who was wounded in two places by the open blades of a pair of tailor's shears, the one entering the abdomen about two inches above the anterior superior spinous process of the ilium, on the left side (from which wound about four inches of omentum protruded), the other entering near the spine, on the same side, just beneath the last rib. There were copious discharges of urine from the latter wound for two days. The omentum was cut away, and the bleeding vessels secured by ligatures. Recovery ensued in fourteen days.

Mr. J. Johnston† records a case of recovery, after an incised wound of the kidney, in a man aged thirty-two. The wound was inflicted with a large table-knife, with a blade of eight and a half inches, the whole of which penetrated the tissues. The peritoneal cavity was opened. Painful spasmodic retraction of the testicle was the prominent symptom, and led the man to suppose that he had been stabbed in the groin. There was much hæmorrhage from the wound, and within an hour after its infliction a pint of blood was passed by the urethra. Symptoms of peritonitis followed, and a perinephritic abscess had to be opened; quantities of urine escaped through the abscess opening. The patient made a good recovery in about six weeks, and it is to be inferred, though it is not stated, that a permanent urinary fistula was escaped.

We learn from the "History of the American War,"‡ that *gun-shot wounds* are often associated with wounds of the stomach, spleen, liver, diaphragm, intestines, or spine. Such cases are usually speedily fatal from shock, or shock and hæmorrhage conjoined. The least

* "Observations on Wounds of the Abdomen;" *Lond. Med. Gazette*, vol. xx., p. 549; 1837.

† *Brit. Med. Journal*, p. 275; April 4th, 1857.

‡ "Medical and Surgical History of the War of the Rebellion," part ii., vol. ii.

complicated cases are observed when a ball enters in the lumbar region and penetrates the cortical substance; whereas if the peritoneum is also wounded urine escapes into the cavity of the belly, and fatal peritonitis is almost inevitable.

The experience of that war seems to justify the view that for the escape of urine from the kidney into the parts around, the pyramidal structure at least, if not also the calyces or the renal pelvis, must be wounded. Urinary infiltration into the retro-peritoneal tissue does not seem to be a common consequence of shot wounds of the kidney.

During the war, a total of seventy-eight cases of gun-shot wounds of the kidney were recorded. Of these, fifteen cases of wound of the right organ were associated with wound of the liver; six of the left kidney with wound of the spleen; seven cases of wound of one or other kidney were complicated with wounds of the intestine, and five with wounds of the spinal column. Fractures of the lower ribs were frequently associated with renal injuries. In six out of nineteen other cases, the renal wounds caused death in the first few days from shock or hæmorrhage; and two men lingered for seven and nine months respectively, and died of exhaustion from suppuration. Of twenty-six cases of recovery, thirteen were wounds of the right and twelve of the left kidney; in one case the side is not stated. Fifteen were pensioners, and appeared to have been alive ten years at least after receiving their wounds. In six of the successful cases the liver was also wounded. All the six cases in which the spleen was wounded were fatal.

But it is stated that though the instances of recovery from shot wounds of the kidney reported during the war are not infrequent, they are generally wanting in such details as would establish them as unequivocal.

A case* is given of quite miraculous recovery after a gun-shot wound. The injury was followed by considerable hæmorrhage, six days of neglect of treatment, repeated journeys of many miles, a convalescence complicated by typhoid fever, and a renal abscess, which discharged externally, and resulted in a urinary fistula, but which, however, subsequently closed. This case teaches the important lesson that a surgeon should never abandon as hopeless any case of injury, however unpromising it may at first sight appear.

Twenty-one additional instances of recovery from gun-shot wounds, and fourteen of recovery after incised or punctured wounds of the kidney, are collected from various sources, and referred to by the editor, Dr. Otis. No instance of punctured or incised wound of the kidney was, however, known to have occurred in the war of the rebellion.

The sources of danger from penetrating renal wounds are (1) hæmorrhage, if the great vessels of the organ are injured; (2) peritonitis, if the front surface of the organ or any of the adjacent viscera are penetrated; and (3) perinephritis and perinephric abscess, and effusions of blood or blood and urine behind the peritoneum. If the wound is inflicted upon the posterior surface, and neither peritoneum nor the great vessels of the hilum are wounded, recovery may be looked for. Indeed, it is not too much to say that whilst the kidney may recover from very considerable lesions, mere punctures or incisions of its substance are attended with a very small amount of risk.

Convalescence is in some cases prompt, in some it is completed only at the end of many months. A bad prognosis must be given when there is much extravasation, if a foreign body remains in the wound, or if the

* "War of the Rebellion," part ii., vol. ii., p. 164. Quoted from the Confederate States' *Medical and Surgical Journal.*

peritoneum has been lacerated. Wounds of the trunks of the renal vessels are rapidly fatal. When shivering, fever, swelling, and the other signs of purulent infiltration into the cellular tissue, set in, the prognosis is bad, unless early and efficient vent can be given to the matter. Abscesses between peritoneum and muscles, if not opened and thoroughly drained, cause continued fever, hectic, and death, after a long and exhausting illness. Nephritis, cystitis, and peritonitis, are other causes of death.

In gun-shot wounds, secondary hæmorrhage may occur when the sloughs separate, and cause sudden death.

Rayer, whose estimate of the dangers of renal wounds is by no means an exaggerated one, clearly attaches more importance to wounds of the calyces and pelvis of the kidney than to wounds of the surface of the organ. Though agreeing with Rayer in this opinion, yet I do not think experience justifies us in regarding the prognosis of simple wounds penetrating to the cavity of the kidney as unfavourable; certainly they are not to be classed in the same category of risk as wounds of the renal artery or vein.

Urinary fistula of long duration is not a common result, even after gun-shot wounds, for it is only reported in one out of the twenty-six recoveries during the war of the rebellion. There were but few instances of urinary abscesses, and no examples of persistent urinary fistulæ. The duration of life in the fatal cases has varied from a day or two to eight or nine months or more, the early deaths having been due to shock or hæmorrhage, the later ones to protracted suppuration.

Treatment.—"The remedies consist of venesection, mild purgatives, such as manna, oil, etc., frequent emollient enemas, the warm bath generally, and local fomentations, so as to excite diaphoresis

and to moderate urinary secretion, with a diet of the mildest kind, but much restricted in fluids, the indulgence in which even in small quantities should be avoided. Stimulants under any form, particularly those which can at all influence the urinary organs, and blisters and diuretics, are decidedly hurtful. The dressing should be extremely light, so as to admit of free percolation of the urine; the neighbouring parts should be varnished over with some unctuous substance to prevent excoriation, and the bedding should be protected by oilskin. By these means, a few cases that have come to my knowledge have terminated favourably." So wrote Hennen in 1818, and with the exception of venesection and frequent emollient enemata, these directions cannot be improved upon. The experience of recent times has not been favourable to venesection in abdominal wounds; and in the cases of injury to such organs as the spleen, liver, and kidney, the shock and hæmorrhage resulting from the accident often render it unwarrantable.

If, however, the patient is of a good constitution and plethoric habit, and especially if much blood has not been lost in the early stages of the injury, bleeding or the application of numerous leeches (twenty to thirty) to the loin and side of the abdomen will be of service if fever or traumatic peritonitis occurs. When some fragment of clothing, a bullet, or portion of the wounding weapon is left in the wound, it will be right to search for it carefully, with the probe or finger, and if necessary the wound should be enlarged for its removal. Complete rest; rigid diet, consisting only of a little milk and a small quantity of barley water or linseed tea; opium to relieve pain and muscular spasm; and ice to allay vomiting are the points to attend to in the treatment, during the first week or two, of a wound of the kidney.

Mild purgatives and emollient enemata are indicated if the bowels, especially the large bowels, are loaded, but after these have been once freed of their contents, the quieter they are kept the better. It is, however, very undesirable that a mass of hardened fæces should rest in the colon, and act as a source of irritation to the neighbouring injured kidney.

The treatment of the wound cannot be too simple. It should be left open for drainage, unless it be a very large incised wound, when one or more deep sutures may be introduced to bring a part of the edges together. A drainage tube and a piece of lint soaked in carbolised oil, and over this a layer of absorbent cotton-wool, are the only dressings needed for these wounds.

Unless its course be very oblique, it will rarely be necessary to enlarge the wound for the purpose of preventing infiltration of urine. In a case of gun-shot wound, the tissues are at first protected by the eschar of the bullet track, and subsequently by a limiting wall of inflammatory lymph.

We learn from the "History of the American War," that "urinous infiltration in the lumbar cellular tissue does not appear to be common after shot wounds of the kidney. The reason probably is, that the eschars lining the track protect the parts until a limiting wall of inflammatory exudation has taken place. Hence it seems unwise to enlarge the exit wounds at first; but later, the free incision of the phlegmonous accumulations likely to form in the loin constitutes a most important part of the treatment."

If phlegmonous inflammation or extravasation occurs, free incisions should not be delayed, and if a circumscribed collection of urine or blood is formed, repeated aspirations may bring about a cure.

The importance of removing clots of blood from the bladder has been mentioned in describing the treatment of ruptured kidney, and it cannot be too

fully emphasised. The catheter and warm water injections should be first tried, but if these are insufficient, either owing to the quantity of coagula or to their continual formation, median urethrotomy or lateral prostatotomy should be performed without delay. It matters but little whether the bladder be reached by a median or lateral incision, so long as there is a free exit for the escape of the clots. Foreign bodies introduced into the kidney and escaping along the ureter into the bladder require removal. It is impossible to read the account of Hennen's celebrated case, or to have witnessed the sufferings of Mr. Hilton's patient, to whom I have before referred, without feeling convinced that each of them would have been saved a world of pain had cystotomy been performed. In Hennen's case, moreover, the operation would doubtless have led to the early detection and removal of the foreign body in the bladder, to the expulsion of which, along the urethra, the agony of the latter period of the case was due.

That Hennen's long-suffering soldier at length recovered by nature's efforts without an operation is no argument whatever against nephrotomy and urethrotomy in similar cases. Miraculous recoveries must not make us lose sight of general principles, nor extraordinary cures cause us to forget ordinary dangers.

Hæmorrhage should be checked by the internal administration of large and quickly repeated doses of ergot, by the local application of ice, and by well-directed pressure upon the loin; care must meanwhile be taken to secure good drainage of the wound. If life be threatened by hæmorrhage or suppuration, the kidney ought to be removed by lumbar nephrectomy. During the American war of the rebellion, we are told that the practice which Larrey and Dupuytren enjoined, of freely enlarging the lumbar orifices of wounds of the kidney, to prevent the infiltration of

urine internally, or amongst the muscles of the back, does not appear to have been at all followed. "Nephrotomy was not practised. Though there were several instances of lodgment of balls in the kidney, and cases of laceration, without communication with the peritoneal sac, there appear to have been none in which the attendant circumstances were thought to require nephrotomy, or to warrant the operation of extirpation of the kidney." It must, however, be observed that this statement was published in 1876, and referred to a period of from eleven to thirteen years before that, whilst the first nephrectomy was not performed till 1869; and one cannot but feel that with our present experience of these operations, several of the cases might with advantage have been submitted to them.

Simon gave it as his opinion "that it might be advantageous in uncomplicated cases of injury to the kidney, where the kidney suppurated (cases almost invariably fatal) to extirpate the injured kidney. . . I would not hesitate to perform this operation, should an opportunity offer."

Professor von Brun published a case, in 1871, of a man with urinary fistula, following a shot wound received in December, 1870; a portion of the left kidney was extirpated March 23rd, 1871, and death resulted ten hours afterwards. The organ was so adherent that its complete removal was impracticable. It was converted into a large abscess. The right kidney was also dotted with small abscesses, an indication, probably, that the nephrectomy was too long delayed.

Wounds of the Ureter.

With the exception of the gun-shot wound of the ureter in the person of the Archbishop of Paris,* in

* *Gazette des Hôpitaux*, 1848.

1848, and the doubtful case recorded by Hennen,* there does not appear to be any published instance of wound of the ureter alone. None occurred in the war of the rebellion; and when the calibre of the ureter and its source and protected position are considered this is not surprising. In all the recorded cases of wounds of the ureter, whether penetrating or subcutaneous, and whether the kidney has been associated in the injury or not, it has always been the pelvic dilatation of the ureter, that is, the pelvis of the kidney, which has suffered. Hence the diagnosis, symptoms, sequelæ, and treatment of the injured ureter, as far as our knowledge extends, in no way differ from those of rupture or wound of the kidney, nor is there any reason for supposing that they would. The following are the notes of the case of the Archbishop referred to:

During the Revolution of 1848 (June 29), the Archbishop of Paris was wounded by a ball at the upper part of the lumbar region on the right side of and close to the spine. The ball was lodged in the body. He had intense suffering, great depression, paralysis of the limb, but no anæsthesia with it. After recovering from slight collapse, reaction set in, accompanied by continued and acute pain, more especially in the left leg, and down the course of the sciatic nerve. Nausea and vomiting supervened, the countenance became pale and anxious, the abdomen was flaccid, and not at all painful. The wound was enlarged, and unsuccessful attempts were made to extract the ball. There was no urine in the bladder, but a quantity escaped by the wound. Death ensued in eighteen hours. On examination, the ball was found to have fractured the transverse process of the third lumbar vertebra, to have then changed its direction and traversed the body of the same vertebra,

* *Op. cit.*, 3rd ed., p. 430; case lxxii.

and to have divided the cauda equina just below its origin. After leaving the vertebra, the ball had changed its direction again, had passed up toward the left kidney, had divided the ureter near the pelvis, and finally had lodged in the psoas muscle. All the cellulo-fatty tissue about the left kidney was infiltrated with urine, and there was slight ecchymosis in the substance of the organ itself.

Hennen's case is given in full by Rayer, as a case of recovery from gun-shot wound of *the kidney.** Hennen, however, merely relates it as a case of "passage of air by the urethra," after venturing the remark that "air is sometimes, but very rarely, passed from the bladder, most probably from some opening in the ureter communicating with an external wound; or, as in the cases mentioned by Camper,† from ulcerations connected with the intestines." The patient, Augustus Labiche, of the 7th French dragoons, was wounded on the 18th June, 1815, by a musket ball, which entered the left hypochondrium, directly under the twelfth rib, near its anterior extremity, and came out to the left of the second vertebra of the loins, close to the spinous process. Some blood passed through the urinary passage the first few days after the infliction of the wound. Up to the 13th of July the discharge through the wound in the back was very free, and was mixed with thin fæces, and the seeds of fruits which he had eaten. On the 14th air passed through the urethra. On the 20th urine passed from the wound in the back. The passage of air bubbles from the urethra, and of urine from the wound in the back, ceased entirely about the 8th of August, which was fifty-one days after the injury; but six days later, air

* Rayer; "Traité des Maladies des Reins," vol. i., p. 268; case ix.

† "Demonstrat. Anatom. Patholog.," lib. ii., p. 16. *See* also a case by Dr. Fothergill; Duncan's "Medical Commentaries," vol. ii., p. 194.

again passed by the urethra and a urethral discharge appeared. The man soon after began to improve fast; and it was believed by his medical officer that he finally quite recovered.

The most probable explanation of this case seems to me to be this: the initial injury was inflicted upon the parietes and the descending colon, with possibly some contusion of the pelvis of the kidney; but during the progress of the suppuration which followed there came to be a temporary communication between the colon and the renal pelvis. The line taken by the bullet was on a level with the pelvis of the kidney, and altogether above the point of commencement of the narrow tube of the ureter.

Mr. Holmes,* a few years since, recorded a case of great interest, which, at the time, he considered to prove the possibility of a direct and uncomplicated wound of the ureter through the posterior parietes of the abdomen.

A boy, aged thirteen years, was stabbed by a clasp-knife, which entered the back just on the right of the middle line, and about on the level of the posterior superior spine of the ilium. The wound took a direction upwards and outwards, and through it there flowed for two weeks a quantity of a colourless, odourless, neutral or slightly alkaline fluid, of sp. gr. 1008. After this time the flow ceased altogether. The author concluded that this fluid must be either urine from a punctured ureter, or cerebro-spinal fluid, and he strongly inclined to the view that it was not cerebro-spinal fluid. It is quite certain, however, from the composition of the fluid, that it was not ordinary urine, and was much more nearly like cerebro-spinal fluid; and as Mr. Holmes has, in a subsequent communication,† come to the conclusion that

* Med.-Chir. Trans., vol. lx.
† Ibid., vol. lxv.

this case was really one of wound of the theca vertebralis, and not of the ureter, I need do no more than say that he has at least shown, by experiment on the dead subject, that it is possible to wound either the ureter or the theca vertebralis by a stab in the back, at the position of the wound in this boy.

There is another way in which the ureter not only may be but has been wounded, and that is during the removal of ovarian and other abdominal tumours, as well as in the removal of the uterus. In the complete removal of the uterus the ureter stands in very real danger of being divided, especially if the operation is being done for cancer of the cervix. It happened once to myself to divide the ureter on one side whilst removing the uterus for malignant disease; the cervix was so enlarged and infiltrated with cancer that it greatly exceeded the fundus in circumference, and it was quite impossible to incise the tissues clear of the disease without cutting out about half an inch of the right ureter, which was incorporated with the growth on the side of the cervix uteri. The renal end of the divided ureter was turned into the vagina and retained there by a suture. Should the ureter be accidentally torn or cut across whilst removing an abdominal tumour, the renal end must be brought out through an opening made for this purpose in the loin and fixed by a suture to the end of the wound.

It was after an accident of this sort that Simon, of Heidelberg, for the first time successfully removed a kidney in order to rid his patient of a urinary fistula.

Wounds of the Suprarenal Capsule.

One case of gun-shot wound of the left suprarenal capsule is described in the "Medical and Surgical History of the American War of the Rebellion."

The shot had traversed the left lung and the diaphragm, and had lodged in the suprarenal capsule,

where it was found embedded after death. The man lived four weeks, and died of pyæmia.

He suffered "no hæmoptysis, not much oppression of breathing, scarcely any hæmorrhage, no disorder of the uro-poietic functions, and comparatively little shock at the outset; the reverse of what would be anticipated from Kölliker's observation, that the suprarenal capsule is more highly supplied with nerves than any other glandular structure, and that the nervous branches are derived from the sympathetic, pneumogastric, and phrenic nerves."

There are no clinical records of any case of uncomplicated wound of the suprarenal capsule; and we have no observations to show how far injury to these bodies would produce the symptoms of Addison's disease, or lead to the retention in the blood of some poisonous substance which certain physiologists have imagined it may be the function of these bodies to remove.

CHAPTER XIV.

INJURIES OF THE KIDNEY: PROLAPSE OF THE KIDNEY (INJURED OR UNINJURED) THROUGH AN EXTERNAL WOUND.

THE kidney may be prolapsed through a wound either in the back or on the front of the abdomen. When through a posterior wound the peritoneum need not necessarily be injured.

The prolapsed kidney may be either injured or uninjured. The prolapse may take place primarily, that is, at the time of the infliction of the parietal wound; or secondarily, that is, some time after the infliction of the wound as the consequence of coughing, sneezing, or some other considerable muscular effort.

The wound through which the prolapsed organ appears may be inflicted by any cutting, lacerating, or penetrating instrument, or it may be a result of gunshot injury.

When not much injured the kidney should be replaced. Otis gives a case (p. 162) of a man who fell backwards upon a scythe, which caused an incision four and a half inches long, through which the right kidney, slightly wounded, protruded. The bloody effusion was removed, and the kidney returned, and ice applied; bloody urine passed (*per urethram*) during eight days; the patient recovered completely.*

The prolapse may be only partial, *i.e.* only one end of the kidney may protrude. Mr. Vernon† records the case of W. M., aged fourteen, who fell from a height of forty feet and received a wound of the soft parts immediately above the right iliac crest, through which protruded the lower end of the right kidney; a piece of its substance had been chipped out, leaving a gap which would admit the finger end; tenderness of the abdomen, discharge of small quantities of blood-stained urine by the urethra, and free discharge of urine from the wound were followed by recovery in eight weeks.

In such a case as Mr. Vernon's it is to be expected that the quantity of urine discharged through the wound would be considerable and extend over a considerable number of days. The gap in the kidney in question, which admitted the end of the finger, extended, there can be no doubt, into the cavity of the kidney, and this is the condition which, as was stated in the last chapter, is favourable to urinary extravasation; whereas a rent or actual breakage, which does not open up the calyces or pelvis of the kidney, will give issue to but a small amount of, if any, urine.

* Beck; "Chirurgie der Schussverletzungen," s. 543. 1872.
† Saint Bart.'s Hosp. Reports, p. 124. 1866.

The older surgeons, I think, knew this; and, perhaps, John Bell* had it in his mind when he wrote: "If an intestine be wounded it pours out its fæces into the abdomen; if the liver, spleen, or kidney be wounded, *these pour out blood;* if the bladder, then urine filters into the cavity of the belly."

In any case, if the protruding kidney is not severely contused or completely broken up, and if the source of the hæmorrhage is not a branch of the renal artery or vein, and the bleeding can be controlled without securing either of those trunks, the organ ought to be replaced, in a person of young or middle age and of good constitution.

The repeated successes of nephro-lithotomy have proved that recovery without an urinary fistula readily takes place after wounds of the kidney, whether the secreting substance of the kidney is but slightly wounded and the calculus removed from an encysted space within it; or is deliberately broken into with the finger-tip so as to open up a calyx; or is left altogether untouched, and the renal pelvis instead of the secreting tissue is the part opened. The only difference seems to be, not in the certainty of recovery, but in the more or less quantity of urine which escapes from the wound, and the longer or shorter duration of the urinary discharge. The smaller the opening into the cavity of the kidney, whether that opening be made directly into the renal pelvis or through the secreting substance into a calyx, the less the amount and the shorter the duration of the flow of the urine by the wound.

Even if a portion of the prolapsed kidney should be entirely broken off, provided the bulk of the organ were not much bruised, that it were still connected with its pelvis and ureter, and the main blood-vessels were uninjured, I should be disposed to replace

* "On Wounds," p. 311. 3rd ed.

it with the fair expectation that the patient would recover and the remnant of the kidney would be of great future use. The experience of Sir Spencer Wells's case, referred to on page 130, as well as the cases already given, point significantly to this conclusion.

Two cases of stab wound, with hernial protrusion of a kidney through the wound, *and its subsequent extirpation*, are quoted by Dr. L. S. Pilcher.* Briefly given, they are as follows: (1) Stephen P., aged twenty-five years, was stabbed with a knife in the left hypochondrium on June 3rd, 1873; two or three hours after a cough set in, which caused the kidney to protrude through the wound. At the end of twenty-four hours he presented himself at the clinic of Professor Brandt,† in Klausenberg, having a pulse of eighty, a temperature nearly normal, and able to walk to a gallery to be photographed. On the fourth day after being wounded the kidney was drawn out and severed, after its pedicle had been ligated. Rapid recovery resulted. At no time did he show symptoms of uræmia or peritonitis. The quantity of urine secreted increased daily while he was under observation. Twenty days after the injury the patient left the hospital, and was able to work as before.

(2) In January, 1875, an Arab girl,‡ of about fifteen years of age, was stabbed with a knife in the loin; the right kidney was wounded, and was forced out of the abdomen between the lips of the wound by which it was partially strangulated; a ligature was thrown around the pedicle formed by the vessels and ureter, and gradually tightened; at the end of six

* Pilcher‖; "Annals of the Anatomical and Surgical Society," vol. i., p. 51; 1878-9. Barker, in Medico-Chir. Trans., vol. lxiii., p. 185, also gives abstracts of this and the next case.

† *See* for fuller account, *Wiener Med. Wochenschrift*, 1873.

‡ Marvaud, "Recueil de Mém. de Méd., de Chirurg.," etc., vol. xxxi., p. 502. 1875.

weeks the very slight pedicle still remaining was cut through and the organ was removed. The girl made a rapid recovery, and subsequently remained in perfect health.

CHAPTER XV.

PERINEPHRIC EXTRAVASATIONS, TRAUMATIC AND NON-TRAUMATIC.

THE cellular tissue surrounding the kidneys not unfrequently become the seat of very extensive extravasations of air, blood, urine, fæces, or pus; and great care is sometimes needed to form an accurate diagnosis as to the nature of the swelling and the precise locality of the effused fluid. In the case of air, a distended colon may be supposed to exist; in the case of blood, urine, or pus, it is sometimes very difficult, if not quite impossible, to say whether the swelling caused is inside or outside the kidney proper. This is still more difficult when the extravasated fluid is fairly circumscribed or positively encysted.

In these extravasations the kidney is often greatly involved, if it be not the original source of the fluid. A ruptured or lacerated kidney may be the cause of a blood tumour in the surrounding tissue; a ruptured renal pelvis may be the cause of an encysted or diffused swelling due to the escape of urine; a renal abscess or suppurative pyelitis may lead to diffused suppuration or an abscess in the circumrenal tissue. On the other hand, air, blood, pus, or fæcal matter may be derived from the cæcum, colon, or other source, and give rise to a tumour in the loin or renal area of the abdomen; the kidney itself remaining

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an interesting case, under the care of Dr. in the Middlesex Hospital, of aneurisms of liac axis and superior mesenteric artery, for atment of which compression, by means of the inal tourniquet, had been employed, there was ive emphysema in the cellular tissue behind scending colon. The small intestines were mosed, and at one spot the coats were thinned,

uninvolved, though during life some doubt may exist as to whether it is so or not.

Air.

This is but little likely to cause any suspicion as to the kidney being affected; for though, when extravasated into the cellular tissue, air may give rise to a bulging in the loin, percussion at once yields a resonant, or, at least, not a dull note, even if the parietes are very thick. Air, however, is occasionally found in considerable quantity around the kidney after injury to that organ. It was so in the following case, which was brought into the Middlesex Hospital in 1874. James L., aged thirty-five, a painter, fell from a scaffolding on to the top of some railings on May 18th. He was a strong muscular-looking man, but with a firm anchylosed angular curvature in the middle of the dorsal region. There was a penetrating wound of the left loin three inches from the median line and immediately below the ribs, and a second wound a little above the first, passing between the eleventh and twelfth ribs. He was greatly collapsed on admission, and died at 3 a.m. on the morning of May 19th. At the post-mortem examination, made eleven hours after death, the cavity of the chest was barrel-shaped from the spinal deformity; the left pleural sac contained two or three ounces of blood; the eleventh and twelfth ribs on this side were broken, and the diaphragm close by was punctured. Through this puncture a piece of omentum projected, covered by a sac of peritoneum, which at this part was unopened. The lower wound had penetrated the peritoneal cavity, and into it a piece of omentum projected, and to it the great intestine had already become adherent by recent lymph. The left kidney was bruised, and its upper part lacerated, either by the spike or by a fractured rib; blood from it was effused into the

peritoneal cavity. The psoas muscle was much torn, and blood was extravasated into its substance. The tips of the transverse processes of the three upper lumbar vertebræ were broken off. A large quantity of air was effused into the subperitoneal tissue of the loin.

In this case it would seem that the air had entered from without through the wound in the loin. There is no mention of the lung being wounded; and the hole in the diaphragm, incomplete so far as the peritoneum was concerned, had been plugged by the herniated piece of omentum.

The source of the air is not always traceable, but its distribution is often very extensive. In a case admitted into the hospital, with fractured pelvis and rupture of the ilium just where it entered a hernial sac, there was a large quantity of air behind the peritoneum of the pelvis and both loins, and it had diffused itself along the vertebræ behind the diaphragm, into the posterior mediastinum and thence to the neck, from which it spread downwards, guided by the cervical fascia to the shoulders, arms, and pectoral regions. All these parts were distinctly distended with air, and crepitant to the touch. The source of the air could not, however, be traced; there was no injury to the lungs, no rent in the peritoneum, and the only apparent source was a perineal incision, which had been made on account of a rupture of the urethra which complicated the fracture of the pelvis.

In an interesting case, under the care of Dr. Cayley in the Middlesex Hospital, of aneurisms of the cœliac axis and superior mesenteric artery, for the treatment of which compression, by means of the abdominal tourniquet, had been employed, there was extensive emphysema in the cellular tissue behind the ascending colon. The small intestines were ecchymosed, and at one spot the coats were thinned,

and there was some submucous emphysema. The large intestines were normal.

It is quite possible that the air in this case had simply transuded into the retro-peritoneal tissues through the thinned wall of the ileum.

Wounds of the loin, groin, and perineum, whether complicated by wounds of the bowel or not, and fractures of the lower ribs with injury to the lung, may be the cause of this form of extravasation. Retro-peritoneal abscess opening into the bowel may of course give rise to it. Decomposition may in some cases explain the presence of gas in the retro-peritoneal tissues.

Blood.

Blood may be effused around the kidney from a ruptured artery or vein, or torn capillaries. Violence inflicted upon the loin is very likely to be followed by extensive extravasation of blood into and beyond the region of the kidney; and the hæmatoma so caused may, after a varying period of from many days to some few months, break down and suppurate. Injuries to the loin are sometimes followed by extravasation of blood beneath the fibrous capsule of the kidney, between the capsule and the glandular substance, as well as into the abundant circumrenal cellulo-fatty tissue, without the occurrence of any rupture of the renal capsule. In a case reported by Mr. Poland,* and referred to in the chapter on subparietal injuries of the kidney, this state of things was found.

In other cases in which the renal substance is lacerated, or the kidney is actually ruptured into two or more pieces, great quantities of blood are rapidly poured out into the retro-peritoneal tissues. Instances of this sort are mentioned in the chapter on subparietal injuries of the kidney.

* "Guy's Hospital Reports," vol. xiv., p. 86; third series.

In one of the cases in the Middlesex Hospital series, a considerable quantity of effused blood was found around the kidney, but the only evidence of violence exhibited by the kidney itself was the presence of a little blood in the renal pelvis.

It would be possible to refer to many cases in which most extensive retro-peritoneal hæmorrhage has followed upon fracture of the pelvis or lumbar spine.

Everywhere the retro-peritoneal tissues are rich in blood-vessels, and the anastomoses between the vessels of the parietes and those of the viscera are numerous and important, both in the loins and pelvis: these vessels are not unfrequently the sole source of considerable blood extravasations.

The rupture of muscles, such as the psoas and quadratus lumborum, is sometimes the cause of most extensive hæmorrhage around and beyond the kidney. So also is the rupture of an aneurism of the abdominal aorta.

The extent of the effusion in cases of ruptured aneurism is sometimes astounding, for the blood by degrees dissects up the peritoneum, and permeates the cellular tissue in every direction, causing the ribs and loins to bulge outwards; it may also carry forwards the posterior and lateral layer of peritoneum and the abdominal viscera, so that the abdomen protrudes in front; and the blood may, moreover, descend along the psoas and iliacus until a fluctuating tumour is formed in each groin, even below the level of Poupart's ligament. There usually is not the least pulsation in such swellings, and unless the clinical history of the case is known, the diagnosis is very difficult, if not actually impossible. In some cases there has been an attack of syncope to mark the bursting of the aneurism; but life may continue long afterwards, and the slow course of the disease, with the absence of

every characteristic sign of aneurism, will probably lead to the supposition that the swelling is malignant.

Erosion of the vertebræ from pressure of the aneurism may give rise to more or less pain, or even to some degree of flexion of the thigh, and then there is a risk that the swelling in the loin and groin or iliac region may lead to the mistaken diagnosis of perinephric abscess, or lumbar caries with abscess. To open such a swelling with the view of evacuating pus would be a very serious, and might prove even a fatal, mistake. A few cases of ruptured abdominal aneurism leading to retro-peritoneal hæmorrhage are recorded in the Transactions of the Pathological Society of London.*

In a case† which I saw during life and examined after death, an enormous tumour, adherent over a large surface to the peritoneum lining the front and lateral wall of the abdomen, had everywhere pulsated; nothing but skin and condensed cellular tissue formed its posterior limit; and finally it ruptured into the peritoneum, just above the cæcum and the right kidney. The kidney and the vena cava were pushed far forwards, so as to form part of the front limit of the tumour.

The kidney may be raised so completely by the extravasated blood as to present a tumour anteriorly in the hypochondrium. A striking case of this sort is described by Dr. Silcock in vol. xxxiv. of the Pathological Society's Transactions. A labourer, æt. 40, came under treatment at St. Mary's Hospital, on October 25, 1882, because of a "burning kind" of pain in the whole of the left lower limb. Within two months (Dec. 15th, 1882) the pain had affected the right hip and the small of the back, and there was great tympanitic distension of the abdomen.

* *See* especially vols. i., iv., xix., xxi., xxii., and xxxiv.
† Trans. Path. Society of London, vol. xxii., p. 104.

A fortnight later still (Jan. 2nd, 1883) the abdomen became tender, and *in the right hypochondrium there was a distinct tumour, which the autopsy showed to be the kidney displaced forwards.* Both legs were œdematous. On January 4th, 1883, he died somewhat suddenly. The patient had enjoyed good health till two years previously, since which time he had had attacks of "rheumatism" in the left hip and leg lasting a week or two. No abnormal pulsation was discoverable in the abdomen from first to last whilst under treatment. On opening the abdomen the whole of the viscera were displaced forwards by a tumour consisting of blood clot behind the peritoneum. Both kidneys were flattened out on the mass and firmly adherent to the subjacent parts. The right ureter was constricted by old adhesions near the brim of the pelvis, above which point it was considerably dilated. Seven pounds of clot were turned out of the subperitoneal tumour. The blood had been extravasated from a ruptured sacculated aneurism of the aorta springing from the posterior wall of the vessel opposite the superior mesenteric. Some of the clot was recent, much was laminated and evidently had been deposited weeks or months. The mass reached from the tenth dorsal nearly to the fourth lumbar vertebra, and was spread out laterally across the spinal column as far as the outer border of the quadratus lumborum on either side. On this cushion of blood clot the liver, spleen, kidneys, great vessels, and intestines were resting. The extravasated blood had distended the sheath of each psoas muscle; on the left side the muscle was almost totally disorganised (its sheath containing fluid detritus of muscle fibre and blood clot), *thus laying bare the cords of the lumbar plexus, and forming a fluctuating tumour which passed beneath Poupart's ligament in the position of and simulating an ordinary psoas abscess.* The right psoas was only partially destroyed,

and the effusion did not reach below Poupart's ligament. The spinal column had been much eroded, and in one part the canal was opened and the dura mater exposed over a surface as large as a kidney bean. There were old infarcts in the kidneys, and 400 cc. of clear serum in the abdominal cavity.

A somewhat similar case is recorded in vol. i. of the Pathological Society's Transactions (p. 80), in which the left lumbar region was occupied by the tumour, and the left kidney was displaced forwards in front of the extravasated blood.

Another cause of retro-peritoneal hæmorrhage is ulceration by pressure of an abscess or a tumour. I have recorded a case* in which a stricture of the œsophagus set up suppuration behind the diaphragm, and death resulted from hæmorrhage from the aorta, the coats of which were ulcerated through just above the cœliac axis. Sometimes the cause of the hæmorrhage is not cleared up at the post-mortem examination; thus a woman, aged 38, who died in the Middlesex Hospital of cancer of the vagina and uterus with secondary deposits in the pelvic glands and the lungs, had a tumour the size of a fœtal head in the left renal region. On dissection this proved to be blood which had been effused into the tissues around the kidney. Both kidneys were tough, as were also the liver and spleen. The heart was dilated and hypertrophied.

Diagnosis and symptoms. — The symptoms vary with the extent and cause of the extravasation. When the blood occupies the cellular tissue of one loin, chiefly or entirely, it causes a tumour sometimes difficult to diagnose from a distended kidney. When the effusion, coming from the aorta or an aneurism of the aorta, crosses the spinal column and occupies the

* "The International Encyclopædia of Surgery," vol. v., p. 952. New York, 1884.

whole space between the outer edge of one quadratus lumborum and the outer edge of the other, the whole of the back part of the peritoneum, and with it the viscera, are raised forwards, the whole abdomen becomes distended, and prominent in front, and one or both kidneys may project and form a tumour on the anterior aspect.

Sometimes there is nothing to indicate the onset of the extravasation, not even when an aneurismal sac has given way. Sometimes there has been an attack of syncope at the moment of rupture, but soon recovered from; and subsequently the blood has been effused gradually and over a period of many weeks, or perhaps months, before death has closed the scene. In the case above referred to as being recorded in the first volume of the Pathological Transactions,* "the patient, an attorney's clerk, aged 51 years, had complained of pain in the left lumbar region for about eight months; this having been first experienced after a sudden sensation of syncope while rising from the chair. He rallied under the use of stimulants, and was not very often seen by his medical attendant till about a fortnight before his death. He then complained of debility and increased pain in the lumbar region. His urine was albuminous. There was perceived a well-marked fulness on the left side, permanently raising the false ribs, exhibiting undoubted fluctuation and pulsation, and tending to come to a head. The patient gradually sank from exhaustion." On post-mortem examination, the left kidney was found forced forwards and upwards. The cellular tissue behind the peritoneum invested a large, elongated, and convex black mass, occupying the space between the false ribs and the iliac fossa, and between the vertebral column and the middle of the crest of the ilium. At its upper

* Case 35; by Dr. Day.

part the tumour was not separable from the aorta. It fluctuated freely in all directions. On opening the tumour and removing the clots, a large cavity capable of holding three or four pints was exposed. The aorta communicated with this cavity directly through an oval aperture nearly opposite the point from which the cœliac axis arises. The bodies of the last dorsal, and the first, second, and third lumbar vertebræ, were denuded.

Here, no doubt, the syncope marked the giving way of the aneurism; and the pulsation of the tumour may have suggested the nature of it. But the long-standing pains in the left loin, the albuminous urine, the situation and outline of the tumour, the "*undoubted fluctuation*" in it, and the tendency "to come to a head," were symptoms very likely to excite, in some minds, the suspicion, or more than the suspicion, that the tumour had a renal origin, and that the pulsation was communicated to it from the aorta.

Sometimes the character of the pulsation will be more decisive than that mentioned in the last case, and yet the general position and outline of the tumour resembles very much a hydro-, pyo-, or hæmato-nephrosis. Such a case is described by Sir (then Mr.) Henry Thompson in the fourth volume of the Pathological Society's Transactions (p. 110, case 22). A warehouseman, aged forty-nine, for the last two or three years of his life had observed *a considerable fulness in the left lumbar region;* and, at times, was conscious of pulsation there. He suffered severely from pain in the left thigh and loins. Even eight years or more before death he had experienced exceedingly severe pains on the left side of the lumbar vertebræ and in the left hip and thigh, the course of which corresponded with the course of the anterior crural nerve to the knee. He had received a great deal of treatment, but without benefit. In July,

1852, a pulsating tumour in the left lumbar region was first recognised. There was an obvious bulging in this situation measuring five inches across, and was more obvious in the stooping than in the standing posture. As he lay on his back, a large resisting mass beneath the cartilages of the left false ribs, and extending two inches across the middle line, could be made out; and on grasping this mass between the two hands *expansion was distinctly perceived with each pulsation.* No bruit could be heard in any position of the patient.

The tumour grew, the health deteriorated, the pains in the loins and thighs were sometimes distressing; and one day (17th of April, 1853) while straining at stool, he was taken with severe shooting pains in the thighs and belly, rose hastily, fell on the floor, became unconscious, and died in about one hour.

On opening the abdomen a firm tumour, nearly as large as an adult head, was seen to occupy the left loin. It was a blood sac communicating with an aneurismal dilatation (from which the mesenteric and other arteries, much dilated, arose) of the upper part of the abdominal aorta by a circular well-defined orifice on its outer or left side. This blood sac was entirely behind the peritoneum; had pushed forwards, and to the right, the stomach, spleen, and intestines; had partly destroyed three of the lumbar vertebræ; and had thinned and become incorporated with the muscles of the back and abdominal walls, behind and on the outer side. The left kidney, of small size, was adherent on the posterior and outer aspect of, and was necessarily removed with, the tumour.

A case which would doubtless have taken the same course as the above-mentioned cases was recently under my care. It was one of aneurism of the abdominal aorta, arising from the vessel as it

passes between the pillars of the diaphragm. There was no sign of aneurism during life; the sac had been in great part destroyed, the cavity was filled with blood clot, and death was caused by gangrene of the right lower limb, brought on by embolism of the common femoral artery and bifurcation of the aorta, and thrombosis of the vena cava and iliac veins. Had life not been curtailed in this way, it is more than probable that hæmorrhages into the retro-peritoneal tissues would have occurred from time to time. The case was reported to the Medico-Chirurgical Society on the 14th April, 1884.*

The amount of blood extravasated has been greatest in cases in which the aneurism has been seated at, or at some spot above, the origin of the superior mesenteric artery.

The symptoms in these cases of retro-peritoneal effusion of blood from abdominal aneurism may be due to either acute or chronic† peritonitis, syncope, or, more frequently still, to anæmia. The blood extravasated is of course as really lost to the individual as if it had escaped through an open wound, but as the effusion is gradual the downward tendency of the patient is gradual also; but day by day, week by week, the life and strength are slowly worn away. The lamination of the clot found in the tissues after death in several of these cases shows that the blood must have been effused gradually, and for many weeks, perhaps some months, before life terminated. Dr. Habershon has told me of a case in a gentleman under his care whose death was very slowly brought about by the gradual effusion of blood behind the peritoneum through a rupture of an aneurism of the abdominal aorta.

When the extravasation is the result of a blow upon

* Trans. Med.-Chir. Soc., vol. lxviii.

† *See* case by Murchison; Path. Trans. Soc., vol. xxi., p. 136.

the loin the symptoms will depend upon the rapidity and extent of the hæmorrhage. If the source of the bleeding is a superficial laceration of the kidney, or a rupture of a lumbar artery, or of one or more of the anastomosing branches in the circumrenal cellular tissue, some days or weeks may be required before the effusion is sufficient to give rise to any swelling or increased dulness in the loin, and no syncope or any sign of faintness is noticed at any time; then after some days the effused blood becomes more solid, and the tumour more irregular, and by degrees perhaps it is absorbed.

In other instances, after becoming harder partly from coagulation and partly from inflammatory effusion around, the blood and clot may disintegrate and be even softer than at any previous time. Under these circumstances the symptoms of suppuration will arise.

When the pelvis of the kidney or one of the calyces is opened, and urine mingles with the extravasated blood, the swelling and dulness of the loin are much more likely to be rapidly developed, and suppuration sooner or later is probably a matter of necessity.

Mr. Marshall's case of suppurating traumatic hæmatoma connected with the left kidney, which was successfully treated by puncture and antiseptic drainage, is a typical one of the sort. (*See* page 150.) Though the hæmatoma in this case had probably undergone incomplete absorption, and ultimately suppurated, it is interesting to note that the patient, whose troubles were caused by the wheels of a spring-cart passing over the abdomen, had very much the same symptoms as those in whom the extravasation was due to ruptured aneurism. These symptoms were severe pain in the flank passing inwards towards the umbilicus, and also affecting the lumbar

spine; pain increased by movement, improved somewhat by rest, but not disappearing entirely; capacity, withal, of getting about; absence of hæmaturia, or other urinary trouble, from first to last; great exacerbation of pain after many months; swelling and tenderness in the left lumbar region and left half of the abdomen; fluctuation across the tumour, which was dull on percussion; pain along the thigh, increased by extension of the limb; pallor; anxiety of features; emaciation, and tendency to death by anæmia. Only there is this most important difference, that in the traumatic case the patient's life was just saved, and a satisfactory result ultimately obtained, by proper surgical proceedings. Aspiration and drainage are feasible and successful in traumatic hæmatoma, but can only hasten the fatal termination when the blood cyst communicates directly and through a large opening with an aortic aneurism.

When the kidney is completely ruptured and the hæmorrhage is both rapid and extensive, there are all the signs of great loss of blood, collapse, syncope, pallor, cold sweats, restlessness, blueness of the extremities, anxiety, vomiting, thirst, feeble, rapid, and irregular pulse, unconsciousness, and death.

As Rayer has pointed out, it is difficult to distinguish during life a tumour formed by an effusion of blood behind the peritoneum and in connection with the kidney from a swelling caused by the kidney itself when dilated with blood or urine and blood. Extrarenal hæmorrhages often give rise to a tumour or swelling soon after the accident, and the tumour is often not circumscribed; whereas the tumour caused by effusion of blood into, or retention of urine within the cavity of the kidney, is circumscribed, and is formed slowly and after a somewhat prolonged period. Yet it will have been observed, in perusing the foregoing cases, that the extrarenal

hæmorrhages are sometimes quite circumscribed, and do not present any noticeable swelling for many months after the outset of the effusion.

Prognosis and treatment.—Recovery may take place after very extensive traumatic hæmorrhage; but retro-peritoneal hæmorrhages due to aneurism are almost certainly fatal in course of time, though it may be very slowly, as the cases quoted here prove.

If recovery takes place the extravasated blood may remain unabsorbed, as a mass of blood clot in the more or less consolidated circumrenal cellular tissue. Such a case is given in chapter xii. from the museum catalogue of St. George's Hospital. Or it may suppurate and open spontaneously through the loin, or drain away through an incision made by the surgeon for that purpose.

If the hæmorrhage increases, or if suppuration occurs and surgical aid is not brought to bear upon the case, death may occur from peritonitis due to tension upon or rupture of the peritoneum; or the colon may be penetrated and fæces and flatus may enter the blood tumour and give rise to decomposition, septic absorption, and death from septicæmia.

When the hæmorrhage is due to aneurism little or nothing in the way of treatment will avail; when due to injury the treatment must be based upon the principles stated in the chapters on injuries to the kidney.

URINE.

Urine is extravasated into the loin behind the peritoneum from ruptured kidney or pelvis of kidney, or from direct penetrating wound the result of operation or accident, or as a consequence of ulceration of those parts. Ulceration of the ureter, whether as a sequel of injury or of the pressure of a tumour, may cause urinary extravasation into the loin, or iliac region. I have related a

case in which a large sarcoma the size of a cocoa-nut caused complete ulceration of the right ureter.*

When urine escapes from the pelvis of the kidney or the upper end of the ureter it diffuses itself sometimes very rapidly in the loin and parts beyond, and may displace forwards the liver, spleen, stomach, and intestines in the same manner as blood has been described as doing. The inflammation excited in the cellular tissue may run on to suppuration, and this may be followed by pointing of the matter in the loin or groin; or, if caused by the escape of only a small quantity of urine, the cellulitis may stop short of suppuration, and, becoming chronic in character, may spread slowly towards the iliac fossa and brim of pelvis, and cause contraction of the ilio-psoas muscle. Under these last-named circumstances, a firm hard swelling will remain in the iliac or lumbar region for many months, but ultimately may clear up and the contraction of the iliacus and psoas and of the muscles of the anterior parietal walls of the abdomen on the affected side, will yield to gentle use and shampooing, or to one of the many modes of making extension.

In the case reported by Mr. Bennett May, and to which reference was made in chapter xii., there was no tumour nor any distinct swelling in the loin, but only dulness and fulness. The withdrawal, on the sixth day after the injury, of seven ounces of bloody urinous fluid of ammoniacal odour, gave immediate relief, and the patient felt quite well and left the hospital on the sixteenth day after the injury. But soon after leaving his pains began to return, radiating into the scrotum, thigh, and lower part of the abdomen along the branches of the lumbar plexus. After a time (two and a half months from the injury) the thigh became flexed; and

* *See* an article on injuries and diseases of the abdomen, in the fifth volume of the "International Encyclopædia of Surgery," p. 948.

deep in the iliac fossa there was an indurated swelling due to cellulitis of a chronic character; this had induced contractions of the iliacus and psoas muscles, and, in consequence, the flexion of the thigh. The patient subsequently quite recovered without suppuration, the thigh straightening out under extension by means of weights and pulleys. In this case the chronic cellulitis was set up by urine extravasated at the time of the injury, or as a result of the puncture. Mr. Bennett May himself is of opinion that there had been extravasation of urine from a torn ureter.

In some instances the effused urine becomes encapsuled within a thick-walled cyst, of inflammatory formation, and with the cavity of this cyst, which may contain pus as well as urine, the kidney communicates at the point of rupture or ulceration. This was the condition in one of Mr. Stanley's cases. * The effused urine is sometimes very dilute; and it has been suggested by Mr. Reginald Harrison that this is probably the reason why the destructive effects so often seen when urine is extravasated from the bladder and urethra, are sometimes escaped in ruptured pelvis of kidney. Owing to the deficiency of salts, such as urea, which produce ammoniacal decomposition, the escaped urine fails, he believes, to arouse active inflammatory changes. This alteration in the character of the urine effused from a damaged kidney, Mr. Harrison considers to be brought about in all probability by thrombosis of the renal vessels. Certainly, as Mr. Poland and Dr. Moxon have shown, the blood-vessels of a kidney which has been injured are sometimes found to be in a thoroughly infarcted state. But in cases in which the cavity of the kidney is opened and the ureter is plugged by blood clot, the

* Med.-Chir. Trans., vol. xxvii.

urine which escapes into the surrounding tissues will have been secreted under considerable pressure; and it has been shown by experiments on animals whose ureters have been tied, as well as by numerous cases of hydro-nephrosis in man, that when urine is secreted under resistance to its outflow it has a very low specific gravity and contains very minute quantities of urea.

Thus Mr. Harrison's theory of renal thrombosis to explain the altered character of the urine and the absence of severe inflammatory changes in the circum-renal tissues, though ingenious, is not always requisite. But, further, it is well nigh certain that healthy urine, if not extravased in very large quantities, or at least not at a very rapid rate, does not necessarily excite suppuration or sloughing of the tissues into which it is effused. Recorded cases of injured kidney show that the urine sometimes escapes very slowly into the tissues around; and days or weeks, or even months, may elapse before there is any local swelling sufficient to suggest extravasation. Healthy urine, moreover, has been known to escape into the peritoneal cavity without exciting peritonitis, and there are good reasons for believing that the peritoneum can absorb a moderate quantity of healthy urine. Mr. Thornton has related to me a case in his practice which proves that the diffusion and passage of urine throughout the abdomen may occur without exciting peritonitis. During an ovariotomy it happened that the ureter was divided, and all the urine secreted by the kidney to which it belonged was for a time discharged into the peritoneal cavity. Urine at length escaped by the abdominal incision, and when the nature of this fluid was verified nephrectomy was performed and the patient made a good recovery.

One feature which is sometimes noticed in cases of

urinary extravasation from the kidney must be mentioned, because when it occurs it forms a serious complication in the treatment by lumbar incision; and sometimes has seemed to necessitate nephrectomy. This is the deposition of the phosphates, in large amounts, in the space or cavity into which the urine is effused. These deposits are large enough to block the drain tubes, and sometimes have to be removed in masses as large as beans or hazel nuts in order to maintain a free discharge of pus and urine through the opening which has been made by the surgeon; Mr. Barker's case* affords an illustration of this; the pelvis of the kidney had been ruptured, and the lower end of the kidney formed part of the wall of the urinary abscess, and was covered with lymph and phosphates; frequent blockages of the drain tubes by masses of phosphates had occurred prior to the nephrectomy which was ultimately performed. The same kind of accumulation of phosphatic concretions in and around the drain tubes has been noticed many times after nephrotomy for pyo-nephrosis.

Treatment.—The proper treatment of urinary extravasation when once the diagnosis is clear consists in withdrawing the effused urine, so as to avoid the destruction of the retro-peritoneal tissue. When the diagnosis is uncertain, but from the fulness and dulness of the loin there is reason to think that urine is escaping behind the peritoneum, the aspirator needle should be inserted at the spot where the fluid is suspected to be. A single introduction of the needle has in some cases withdrawn all the fluid, and convalescence has forthwith commenced. In other cases, where the effusion continues and the swelling in the side again and again reforms, a lumbar incision and drainage are needed. When suppuration is aroused a

* *Lancet*, January 17th, 1885.

free incision ought not to be delayed. Nephrectomy will be requisite if the kidney is greatly damaged by the original injury, or in large part destroyed by subsequent abscess; it will also be advisable in certain cases in which the fistulous opening into the kidney or its pelvis does not close after aspiration or drainage, and where the continuous drain of urine and pus from the loin is exhausting the patient's strength by fever or exposing him to the risks of blood poisoning or albuminoid changes in the viscera. When the primary incision and drainage are too long delayed these dangers are real, because the retro-peritoneal cellular tissue is not only widely affected, but the suppurative process will have become chronic. But when an early incision down on to the kidney is made from the loin, the kidney injured by accident (provided the injuries are not very extensive) is put into the same position for recovering as a kidney which has been opened for the extraction of a calculus by the operation of nephro-lithotomy.

Fæcal extravasation requires no special description in a work on the kidney. For an account of this condition I may refer the reader to an article by the author in the fifth volume of Ashhurst's "International Encyclopædia of Surgery."

Purulent extravasation will be considered in the chapter on perinephric suppuration.

CHAPTER XVI.

PERINEPHRITIS AND PERINEPHRIC ABSCESS.

PERINEPHRITIS is inflammation of the cellular and adipose tissue surrounding the kidney. Perinephric abscess is applied alike to all forms of pus formation in these tissues, to diffuse suppuration no less than to single or multiple collections of pus.

Perinephritis has been met with at all ages, from five weeks old upwards. Perinephric abscess occurs more commonly in adults; but as the result of injury it may arise at any age. Though perhaps more frequent in men, the abscesses are often met with in women. In some few instances they are idiopathic in origin, and quite simple in their course and termination. In many they are symptomatic, and after running a complicated course terminate fatally.

From very ancient times renal abscess, pyo-nephrosis, and calculous pyelitis have been known to end in suppuration around the kidney, necessitating the evacuation of pus by an incision in the loin. But it was only at and since the time of Rayer that special attention was paid to abscesses situated outside the kidney, and due to causes independent of the kidney.

It was, so far as I know, Rayer himself who gave the first systematic account of perinephric or extra-renal abscesses. He classified them into three groups, and collected typical examples of each group. Since Rayer wrote, many authors have contributed additional materials, but none have given a clearer or more accurate description than his. The three classes of cases, according to Rayer, are: (1) *Primary* extra-renal abscesses, or those which are independent of

any fistulous opening into, or other disease of the kidney. (2) *Consecutive* extrarenal abscesses, comprising cases in which the abscesses are secondary to an inflammation of the kidneys, *i.e.* in which the inflammation has spread to the cellulo-adipose tissue by contiguity, but without urinary infiltration. (3) *Consecutive* extrarenal abscesses, formed in consequence of a fistula communicating between the renal cavity or renal substance and the surrounding cellulo-adipose tissue; and generally, though not invariably, due to calculus in the kidney.

Etiology.—As regards the causes of perinephritis, the three classes of Rayer may be treated as two; namely, (*a*) primary and independent of the kidney; and (*b*) consecutive, or due to some disease of the kidney; whilst we must add a third, namely, those consecutive to disease seated in some other organ or structure than the kidney.

(*a*) Amongst the primary cases many are traumatic in origin, others are due to the influence of causes which excite rheumatism. The various injuries to which the loins are liable, such as blows, strains, punctured and incised wounds, whether they involve the kidney or not, and whether urine is extravasated or not, are prone to excite perinephritis.

Dr. Dickinson has recorded a case of perinephritis in a gentleman, aged forty-three, a free liver and of tuberculous tendency, due to the severe bruising of the loin by the rolling and tossing of the vessel during a very rough voyage from Queensland to England. Three pints of pus were let out through an incision in a tender spot in the loin; the wound healed within a month after the incision, but two months after the closure, hæmoptysis, succeeded by profuse purulent expectoration, occurred. For a time the expectorated pus amounted to fifteen ounces a day. Emaciation and weakness so increased that the patient

died in three months from the date of the hæmoptysis. It would appear that in this case the abscess was opened too late and allowed to close too soon.

Poland tabulated twenty-eight cases of primary abscess (these include sixteen from Trousseau's article, ten from Bowditch's, one of Mr. Bryant's from Guy's Reports, and one of Hughes's from the second volume of the Pathological Transactions, p. 235), the causes of which are given as follow: Falls and contusions, three; jolting of carriage, one; fatigue in walking, one; muscular effort (digging), three; debility, one; uncertain and insidious, four; no cause assignable, six; cause not stated in six cases. In three cases there is a doubt as to whether the abscesses were strictly primitive or were not rather consecutive; in one of the doubtful cases the abscess occurred thirty-two days after the removal of a testicle of the same side (Chopart); in another, fifteen days after an abscess of the broad ligament had burst into the bladder and vagina; and in the third, calculi had been passed four years before, and the patient had latterly suffered from pyelo-nephritis.

A sudden chill, especially after exposure to great heat, and after sweating, is an exciting cause; under this heading Rayer quotes two cases, M. Bland's and Dr. Thomas Turner's (pp. 255—257). Sometimes, as the result of various depraved states of the blood, perinephritis occurs during the course of, or as a sequel to, the continued and exanthematous fevers. A case of much interest, which has been quoted by many subsequent writers, was described by Dr. Butter* as due to a peculiar irritative fever, commonly called the Plymouth Dockyard disease. This disease seems to have been a particular form of septicæmic cellulitis.

(*b*) Perinephritis most frequently originates in

* *Edin. Med. and Surg. Journal*, vol. xxvi., p. 106.

suppurative pyelitis, nephritis, or pyelo-nephritis, by extension through or actual perforation of the capsule. In some cases the kidney affection is secondary to inflammation of the bladder; in others it is due to tubercle, cancer, cystic or hydatid disease of the kidney itself; in others, again, and much more frequently, to calculus within the kidney.

Urethral stricture, vesical calculus, and prostatic disease may each lead to acute or chronic perinephritis by first exciting pyelitis, pyelo-nephritis, or pyonephrosis. Evidence of chronic perinephritis is often seen in the post-mortem examination of such diseases of the lower urinary tract as just mentioned, and is furnished by the induration of the circumrenal cellular tissue, and by the thickened and firmly fixed renal capsule which is left behind on attempting to remove the kidney. In acute cases of this kind the capsule is found to be very vascular, and numerous abscesses are formed in the inflamed cellular tissue around the capsule. In time these small abscesses coalesce, and burrow far and wide, if they do not soon open into the colon at the loin, or in some other direction.

In certain cases the spread of the inflammation has been by direct contiguity, as when numerous miliary abscesses are formed at the outer surface of the kidney* in pyelo-nephritis. In others, abscess in the circumrenal cellular tissue has followed repeated attacks of the gravel or of renal colic, without there being any perforation of the renal capsule. Andral† records a case of perinephric abscess which followed chronic inflammation and atrophy of the kidney, and Rayer gives the particulars of the case of a woman, aged sixty-five, who suffered from extra-renal abscess, excited by a tumour of the kidney, which persisted after the cure of the abscess by an

* "Bull. de la Société Anatomique," tome i., p. 69; 1835.
† Andral, "Clinique Médicale," tome iv., p. 188. 2nd edition.

incision in the loin three inches long (p. 264). In another case of Rayer's, a perinephric abscess of the left loin followed dilatation and suppuration of the left ureter; the right ureter, calyces, and pelvis were dilated and suppurating, the whole being due to a fungous cancer of the bladder.

Perinephritis, when induced by simple extension of inflammation from within the kidney, and not by extravasation following perforation, is preceded by inflammation of the fibrous tissue of the kidney (paranephritis).

The cases of perinephric abscess consecutive to renal fistula are chiefly due to calculous pyelitis. These are very numerous. Lafitte, in 1734, recorded three such in his article on *cases in which nephrotomy is practised with success.** Others arise from tubercle, cancer, hydatid penetrating or lacerating wounds, etc.

A renal calculus, after destroying to a greater or less extent the renal structures, may ulcerate through the capsule and lie loose in a suppurating space behind the kidney. Tuberculous matter may lead to ulceration of the capsule, and sprout, fungus like, into the tissue around the kidney; or perinephric abscess may be induced by the presence of tubercle in the kidney, without the renal capsule being previously perforated.

Perinephric abscess is almost certain to arise if urine, pus, a calculus, or hydatids escape from the kidney into the circumrenal cellulo-adipose tissue.

(*c*) Perinephritis is often a consequence of the extension of inflammation from distant parts, such as the pelvis, colon, testicle, spermatic cord, spleen, liver, gall bladder, or vertebræ. So easily can inflammation which begins in the pelvic or iliac regions spread upwards to the loins, along the veins or along the

* "Mémoires de l'Académie Royale de Chirurgie," tome ii., pp. 233-237. In 4to.

retro-peritoneal connective tissue, and there give rise to an abscess around the kidney, that diseases of, or operations upon, the rectum, urinary bladder, testicle, or the uterus, and cellulitis arising during the puerperal state, are well-known causes.

Perforation of the gall bladder by a gall stone (Trousseau), of the colon by a pin (Rayer, p. 247), or of the diaphragm by an empyæma or a pneumonic abscess have been recorded as causes of perinephritis. Perforation of the ileum by a typhoid or scrofulous ulcer has been thought to be an occasional cause (Trousseau); so also are typhlitis and perityphlitis. Castration, excision of the rectum, lithotomy, the injection of a hydrocele, incision of hæmatocele, the various operative methods of treating varicocele, internal urethrotomy (Roberts), and other operations on the urethra; and diseases of the prostate, urethra, bladder, and seminal vesicles, and even the retention of a catheter in the urethra (Nieden) have each been followed by perinephritis. The inflammation extends by continuity along the retro-peritoneal tissue or veins, without the kidney itself being involved.

In twenty-six instances collected by Dr. Duffin, two were the result of severe injury to the loin; two had a puerperal origin; one followed a renal abscess secondary to lithotrity; one was excited by irritability of the bladder; eight by kidney disease; and in twelve the abscess appeared to have been independent of any affection of the urinary organs. In five of these twelve a sprain in the loin may have been the exciting cause; in three, exposure to cold; and in one, ulceration of the gall bladder.

Symptoms.—The symptoms of perinephritis are not always the same, nor are they always well pronounced, especially in the early stages of the inflammation. They vary with the cause, as well as with the acuteness of the disease. When the inflammation

is secondary to some distant disease, such as puerperal perimetritis, or pelvic cellulitis, the symptoms of the primary affection may disguise those of the perinephritis. Even when perinephritis is the primary disease, the symptoms are sometimes of a most insidious, obscure, or ill-defined character, so that typhoid fever, hip joint disease, rheumatism, or spinal caries may be suspected rather than perinephric abscess.

It is necessary, therefore, to bear in mind that whereas in some cases the symptoms of perinephritis are both locally and constitutionally very pronounced, and the disease is so rapid in its course that a large and fluctuating tumour in the flank may be developed in from ten days to a fortnight; in others, the beginning and early part of the progress of perinephric abscess is undefined and slightly marked, the local pain being either absent, or neglected in consequence of a more severe pain elsewhere, or owing to the severity of the constitutional symptoms diverting observation from the local (Trousseau). It is pretty certain that several cases of perinephritis which do not go on to suppuration, but recover under rest and suitable treatment, are diagnosed wrongly as incipient hip joint or spinal disease.

More generally, however, perinephric abscess declares its presence by symptoms unmistakable. The *constitutional indications* of pus in the circumrenal connective tissue are the same as those excited by deep-seated suppuration elsewhere. Rigors, high temperature, sweating, furred tongue, thirst, loss of appetite, perhaps vomiting, and delirium in the acute cases; constipation, foul tongue, loss of appetite, slight elevation of temperature in the chronic. In other words, the symptoms will be more or less severe according to the acuteness of the inflammation. In old and weakly persons, and when the inflammation

is chronic, the symptoms may be altogether masked; until the abscess, by its size and pressure upon surrounding structures, forces itself upon attention. In some subacute cases the only symptom for several weeks before pus was discovered, or even suspected, has been lameness, attributed to morbus coxæ or to rheumatism.

The febrile temperature does not always take the same course; in some cases it is like the course of typhoid, running continuously high; in others it is intermittent, and suggestive of malaria or pyæmia. The obstinate constipation which, Trousseau remarks, always exists, is certainly a very frequent symptom, and is doubtless due to the loss of, or the dread on the part of the patient of employing, muscular effort.

Of the *local symptoms*, those due to pressure are more marked in perinephric abscess than in perinephritis. Pain is one of the earliest and most prominent indications. Deep-seated and often paroxysmal pain ushers in the disease. The common seat of the pain is the loin and side of the abdomen, but the pain sometimes shoots down the thigh or into the hypogastrium, scrotum, penis, testes, or groin. Its wide diffusion is explained by the anatomical distribution of the nerves of the lumbar plexus, which traverse the renal region.

It is in one case of a dull aching character, in another darting or pricking. Occasionally it may be felt in the knee, as in coxalgia (Gibney). In most cases, the pain which sets in at the beginning continues and increases throughout the progress of the inflammation and until the pus is evacuated; but in other cases the severity of it diminishes temporarily, or the pain disappears entirely for weeks, or even months, encouraging a delusive hope that recovery has taken place (Trousseau and Ebstein). Invariably the pain is increased on pressure, and if the loin be compressed

between the two hands the suffering caused is, in some instances, very acute. For a period varying from a few days to several weeks, no other local symptom but pain or tenderness on pressure over the kidney and in the loin may be present; whilst the constitutional disturbance may or may not indicate that the pain has its origin in a grave and organic disease.

The affected side will often give to the *surgeon* the sense of increased resistance and weight long before pus has formed, or the abscess is large enough to cause any alteration in the outline of the flank or abdomen. This condition will be best detected by lifting, as it were, each loin by the flat hand placed behind, on each ilio-costal interspace; thus simultaneously comparing the resistance offered by the two sides. A feeling of weight in the side is sometimes experienced by the *patient*, who will, perhaps, for days together complain of a sensation of fulness and puffiness in the flank. Later on there will be dulness in the ilio-costal interspace, swelling in the region of the kidney, at first hard and resisting, and if the parietes be thick and fat, indistinct and ill-defined; later on the ilio-costal curve will be quite effaced, and obscure fluctuation may be felt. The skin in the loin is often waxen and œdematous, unless the matter makes its way to the surface, and then it becomes congested. After a time deep-seated fluctuation may be detected in place of the hard resistance previously felt; but this will depend much upon the thickness of the abdominal parietes. I have known as many as six pints of pus pent up, presumably for several weeks, in a perinephric abscess, and yet no fluctuation could be made out, owing to the enormous thickness of the subcutaneous fat. In this case the patient had suffered and recovered from an acute abscess in the testis of the same side, before the commencement of

the perinephritis; both abscesses were caused by calculous pyelitis.

Retraction of the testis has been noticed in some cases; it is most likely to occur when perinephric abscess is caused by calculous pyelitis, but is not restricted to such cases.

I have seen œdema of the foot and ankle precede for many weeks every other sign of perinephric abscess. Pyelitis had existed for a long time, and shown itself by a small quantity of pus in acid urine, frequency of micturition, constipation, flatulence, debility, and anorexia; then came the œdema of the limb, but without pain; and then, after a long railway journey, came pain in the loin and same side of the abdomen; the pain rapidly increased, and was followed by fulness, hardness, and dulness, and at last by redness and œdema in the loin. Nieden gives one case in which œdema of the lower extremity was noted.

A peculiar lameness is often an early symptom, and is due to the flexed position in which the thigh of the affected side is retained, in order to relieve pressure upon the inflamed tissue. Sometimes the patient walks with the body bent forwards and inclined to the affected side, with the hand of the same side resting on the middle of the thigh. The sitting attitude is also, and for the same reason, characteristic; the patient sits on one tuber ischii, so as to relax the psoas muscle of the other side. Dr. Duffin, in his excellent summary of twenty-six cases, has drawn particular attention to this lameness as a diagnostic sign, and points out its association with another tendency of perinephric abscesses, namely, to implicate the pleura and lung. The mechanism of the lameness is explained by the pus following the track of the psoas muscle downwards towards the groin; but as the pus may also pass upwards along the psoas beneath the ligamentum arcuatum, we see

how empyema or pulmonary fistula may be likewise caused.

An inability to extend the thigh of the affected side has also been an early sign, in my experience. I will refer later on to a typical case, in which the flexion of the thigh was a very striking, but, as it happened, a very misleading symptom. It was observed in twenty-seven out of one hundred and sixty-six cases collected by Nieden. It may be only just sufficient to prevent complete extension of the thigh, or so extreme that the thigh is drawn up close to the abdomen. As long as the limb is kept flexed the patient may be easy, but any attempt to extend it causes pain. Sometimes other movements of the thigh as well as extension give pain. Gibney mentions difficulty in voluntary adduction, and in one case towards the end of the disease there was resistance to complete passive flexion. In Nieden's list there is one case in which convulsive movement of the leg was a symptom of perinephric abscess; one in which perinephritis (not abscess) was followed by paralysis of both legs; another in which an abscess on the left side was complicated with pleurisy of the left side, and paralysis of the right arm and both legs. Altogether, in eight cases out of the hundred and sixty-six there was some temporary anæsthesia, or more or less paralysis of the thigh of the affected side.

This bent position of the thigh, like the lameness, and the sitting on one side, is doubtless due to a reflex contraction of the psoas muscle, whereby pressure and tension on the post-renal cellular tissue are lessened and pain is thus relieved. When it is remembered that the nerves of the lumbar plexus pass outwards in very intimate relation with the psoas muscle and post-renal cellular tissue, and in all probability suffer some inflammatory thickening, it is easily understood

that relaxation of this muscle by flexion of the thigh directly tends to put these nerves at ease. To the same end a stooping attitude is assumed, the shoulders are elevated, and the trunk is inclined to the affected side, so as to fix the spine and relax the upper end of the psoas muscle.

The urine affords but a very imperfect aid to diagnosis, because in the first place it may have been long ago changed by antecedent vesical or renal disease; and because, in the second place, if the cause of the perinephric inflammation does not reside in the urinary organs the urine itself may be quite normal, except for the changes due to febrile action; or at most there may be a diminution in the quantity excreted. It, however, may contain albumen, as a result of pressure on the renal vein. When perinephric abscess follows an injury to the kidney region the urine may be at first blood-stained, and afterwards contain pus. Frequent or painful micturition and incontinence of urine have been observed.

The frequency of urinary complications in the twenty-six cases analysed by Dr. Duffin was as follows: Two patients had blood and six had pus in their urine; two suffered from vesical irritation; five had renal disease without bladder signs; twelve were without urinary trouble of any sort. In the two in which blood was voided with the urine, the perinephric abscess was caused by injury to the loin.

The pus contained in some perinephric abscesses is quite odourless, in others fœtid; in a few it has quite a fæcal odour, though no fistulous communication exists between the abscess and the bowel. Rayer pointed this out as occurring in one of his cases in which there was an entire absence of fæcal matter in the discharges, as well as of gas on pressing the anterior abdominal walls, and, indeed, of all signs suggestive of intestinal fistula. Sometimes the symptoms

of pleurisy or pneumonia on the affected side mask those of perinephritis, and the patient appears at first to be suffering exclusively from disease within the chest (Bowditch).

As soon as the pus is evacuated the temperature falls, the pain vanishes, the appetite returns, and the flatulence and constipation disappear. The patient rapidly recovers, provided the incision of the abscess has been made before the pus has burrowed too widely, or the inflammation has set up some dangerous complication.

Perinephritis without suppuration.—The experience gained by a close study of perinephric abscesses, as Gibney points out, has enabled us to recognise the symptoms of perinephritis before the inflammation has reached the stage of suppuration. When, after an injury or otherwise, there is tenderness on pressure in the renal region, and the patient whilst standing or sitting inclines over to the tender side, perinephritis should be suspected. The diagnosis will be made by attention to the following symptoms.

The spinal column is preternaturally stiff, and curved in the antero-posterior direction, though without angular curvature; possibly it will deviate a little from the affected side. There is stiffness in walking, and the body is inclined over to the affected side; so much so, in some cases, that the crest of the ilium is in contact with the lower ribs.

Whilst standing, the body will be flexed upon the thigh of the affected side, and the hand of the same side will rest supporting the trunk on that thigh. The continued flexion of the thigh causes some lordosis in walking. If an effort is made to stand, without support, on the affected side, the body is thrown far over towards that side, and the opposite thigh and leg are strongly flexed. Stooping will be difficult. Whilst lying on his back the patient will not extend

the thigh beyond 160°, and in more severe cases not beyond 130°. There is pain in every movement of the trunk in severe cases, so that the patient may not be able to turn over in bed. Flexion of the thigh will not give pain, but complete extension will not be possible, and its attempt will cause discomfort, if not pain. Abduction and adduction will probably be uninterfered with, but there may be some difficulty in adduction. The patient will be able to stand on the affected limb alone, in the manner described above In mild cases the limb may look straight whilst standing, but when lying or sitting on a hard mattress the ham cannot be made to touch the surface. Occasionally, it has been noticed that the thigh is rotated outwards; when this is so, the heel of the affected side during standing rests upon the dorsum of the other foot. In this state the second stage of hip joint disease is simulated.

When knee joint pain is complained of, as it sometimes is, we must beware of mistaking perinephritis for morbus coxæ. With pain in the knee, lameness, and muscular rigidity about the hip joint, it is too often concluded that we have sufficiently strong evidence of morbus coxæ; but one of the cases reported by Gibney, and another which has passed under my own observation, convince us of the necessity of cautious examination before we commit ourselves to this diagnosis on these symptoms alone.

Gibney further points out, that pain at the hip joint in such acts as pulling on a boot, and resistance to complete flexion, whilst strongly in favour of hip joint disease, are not incompatible with perinephritis.

In perinephritis there is no atrophy of the muscles of the thigh, no shortening of the limb, no fulness or tenderness, on pressure, about the head or trochanter of the femur; no tenderness or pain on succussion or

passive motion of the hip joint; no tenderness over the sacro-iliac joint, and none on percussing the spinous processes or succussion of the spinal column. The tenderness in the loin will be above the crest of the ilium, and one or two inches at least to the side of the spines of the lumbar vertebræ. The tongue will be coated, the temperature raised commonly to 103°, often to 104°, or higher, and the urine will be acid, and without blood or pus, though there will be abundance of lithates, and there may be some albumen.

Thus, with feverishness, without tenderness over the spinal column, and with symptoms pointing to an inflammatory affection on one side of the column, there is an absence of the characteristic signs of disease of the hip and sacro-iliac joints; though a very similar alteration in the attitude, and much the same limitation of muscular mobility of the affected side, exist as in those diseases.

There is no tumefaction in the loin or around the kidney, as in perinephric abscess.

As recovery by resolution occurs, the tenderness in the loin subsides, the temperature declines gradually to 100° and then to normal; sitting is less uncomfortable, and walking more easy, flexion of the thigh is no longer maintained, and extension in dorsal decubitus can be fully and easily accomplished. The tongue gradually cleans, and the bowels act with regularity. At length all inclination of the trunk to the affected side is discontinued.

Pathology.—The area of the cellulo-adipose tissue affected may be very small or very extensive. A purulent collection may be so small that it may be missed by an exploratory incision extending from the last rib to the iliac crest; whilst, on the other hand, pus, if not provided with an opening, may burrow upwards to the diaphragm, downwards to the groin,

and inwards across the middle line to the opposite loin. In acute cases, the fibrous capsule of the kidney may be very vascular and red, and the cellular tissue surrounding it may be infiltrated with serous fluid; or numerous minute abscesses may form in the inflamed cellular tissue; or the inflammation may be lighted up in the whole of the surrounding tissue at once, and suppuration be diffused throughout it.

In some cases the tissue is injected, and œdematous with serum or sero-pus; in others, one or several pints of pus may have formed, and the kidney (little, or not at all, affected) may be detached everywhere from its cellular and adipose surroundings; in others, again, besides pus, stringy, flocculent, and gangrenous masses of the tissue have been found mixed with the pus. In Dr. T. Turner's case, the tissue surrounding both kidneys was gangrenous, and converted into a black pulpy mass, and the fibrous capsule of each kidney was inflamed, whilst that of the right was partly gangrenous, though the secreting substance of the kidneys was but slightly affected. The pathological changes observed in the kidney are frequently those to which the perinephritis was due; in other cases the renal changes are secondary to the inflammation in the perinephric structures. In some cases there has been found general softening of the kidney, but without any purulent depots in the secreting substance, or suppuration in the pelvis, or calyces of the organ. Sometimes the whole or a part of the kidney has been quite liquefied by the solvent action of the surrounding pus and the softening influence of the inflammation.

In a medico-legal case of some importance which arose a few years ago in Edinburgh, a calculus (from which the accompanying figure (15) is taken) had tightly fitted the cavity of the kidney of a woman who was kicked in the loin by her husband. Acute inflammation, followed by an enormous perinephric abscess,

occurred, and soon ended fatally. At the post-mortem examination the lower half of the kidney was quite liquefied; it had entirely lost all the characters of a solid structure, but the calculus had literally to be cut out of the remainder of the organ, to which it accurately and tightly fitted.

Fig. 15.—Calculus tightly fitting the Kidney, and leading to Perinephric Abscess after an Injury. (Middlesex Hospital Museum.)

This abscess had burrowed upwards to the diaphragm, through which it had partially ulcerated over an area equal to a penny-piece; and to the upper surface of the diaphragm the base of the lung was firmly adherent over the partially ulcerated area. So that had the muscle been completely ulcerated through, the pus would have entered a bronchus, and not the pleural cavity. In this case, the large branched stone, weighing 337 grains, was the predisposing, and the kick the exciting, cause of the suppuration; and thus, though the calculus had been unsuspected and previously quiescent, it may be said to have at length destroyed the life of the person whose kidney it had long occupied, though it was the means of saving that of her assailant. I am indebted to my friend Dr. Bendall for the calculus and this brief record of it.

Occasionally a certain amount of blood is effused beneath, as well as upon the outer surface of, the fibrous covering of the kidney; sometimes a number of small ecchymoses are seen in the tissue around.

In some cases pus is found beneath the fibrous tunic of the kidney, as well as in the cellular tissue outside, and the fibrous capsule may be perforated here and there, but thickened, and intimately adherent to the surrounding tissue, at points where there is no pus. Such a condition is usually the result of some cause which has led to the disorganisation of the kidney, more or less, prior to the perinephritis. Pyelitis and pyelo-nephritis are usually associated with this condition.

The pus contained in perinephric abscesses is sometimes colourless, in others fœtid; and, owing to the close proximity of the colon, even a fæcal odour may be present without any fistulous communication with the bowel existing. Occasionally an urinous odour has been noticed.

The seat of the pus, when the suppuration is not due to extravasation from the kidney, is nearly always in the cellular tissue behind the kidney, between it and the muscles of the loin, and with the kidney between it and the peritoneum.

When the perinephritis is the consequence of a renal fistula, the pus will generally be posterior to the kidney. But it may be in front of it, and burrowing along behind the peritoneum, push that membrane forwards, as in the following case, which was in the Middlesex Hospital, under Dr. Powell. Sarah S., æt. 30 (No. 183, 1882), died of scrofulous pyonephrosis and cystitis. The left kidney was large, its capsule very thick, and foci of pus were seen in places beneath the capsule. The greater part of the kidney substance, indeed, was suppurating. A perinephric abscess, situated chiefly in front of the kidney, had burrowed down to the anterior superior spine of the ilium and the brim of the pelvis.

Or the abscess may ulcerate through the peritoneum, and cause death by fatal peritonitis, as in a case

recorded by Gardien;* or it may form an intraperitoneal abscess circumscribed by adhesions.

A perinephric abscess may extend from the posterior border of the liver or spleen to as low as the true brim of the pelvis; posteriorly, it is limited by the aponeurotic and muscular tissues of the loin, which it bulges backwards and outwards, and may destroy more or less by ulceration; and, anteriorly, it may raise forwards the peritoneum, until it forms an enormous tumour, readily detected by looking at the front of the abdomen. On the other hand, in not a few instances the abscess has been so small that after an exploratory incision no pus has escaped, and the diagnosis has been for a moment called in question; but within a few days the matter has found its way into the opening.

In some instances, though the peritoneum may be much raised forwards, and the pus only kept in posteriorly by the skin, the abscess cavity is limited above and below by a tough thick cellular tissue, which shuts off the liver or spleen above, and the iliac fossa below. Andral describes such a case.† Occasionally an abscess in the liver or spleen, according to the side affected, is excited by the inflammation in the perinephric tissues.

In chronic inflammation or suppuration in the perinephric tissue, very firm and tough adhesions are formed between it and the fibrous capsule of the kidney, and between the latter and the cortical substance. Indeed, one sometimes finds the kidney "set," as it were, in a thick frame of cellular adipose tissue, as an anatomical preparation is "set" in plaster of Paris. In such a state it is impossible to separate the kidney without tearing it out of its capsule. Plate I. shows this condition of things, and I have seen exactly the same where the cause of the perinephritis was calculous

* *See* Rayer, p. 252. † *Clinique Médicale.*

pyelitis. Mr. Durham also showed such a case at the Medical Society in February, 1885. Sometimes the fibrous capsule of the kidney undergoes marked changes in the way of fibrous, cartilaginous, or bony thickening in spots. In one instance, in which I laid open a chronic purulent fistula in the loin, I picked from off the capsule a small plate of plastic lymph infiltrated with urinary salts, and which, for the moment, felt like a calculus projecting on the surface of the kidney.

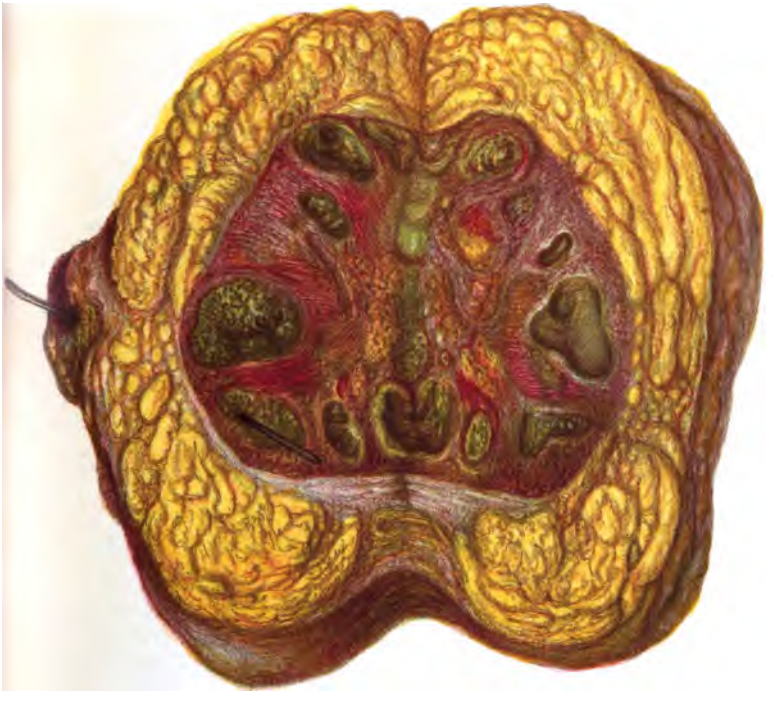
When incision, the only proper treatment in cases of suppuration, has been neglected, the pus may burst in one or more of several directions; in one case it will be into the colon, small intestine, or stomach; in another, into the pleural sac or the lung; in a third, into the ureter; in a fourth, into the sheath of the psoas muscle, and thus make its way to the groin; or it may reach the groin by travelling across the iliac fossa without entering the psoas sheath; similarly, after burrowing through the pelvis it has appeared in the buttock by finding its way through the sacro-sciatic notch; more frequently it reaches the surface at the loin or at some spot posterior to a line drawn from the crest of the ilium upwards to a point one inch in front of the tip of the eleventh rib. Compared with the frequency with which perinephric abscesses perforate the pleura or the lung, the other forms of spontaneous opening are rare. Probably it is not much, if any, exaggeration to say, that of every twelve cases which pursue their own course, four or five open in this direction.

Duffin gives six cases out of twenty-six in which the abscess opened into the colon, one in which it opened into the peritoneum, and one *only* in which it opened externally at the loin. Of the twenty-eight cases of primary abscesses, tabulated by Poland, sixteen were uncomplicated, five burst into the colon, one into

PLATE I.

Suppurating kidney firmly embedded in the cellulo-fatty tissue of the loin.

Plate I.



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the peritoneum, two into the vagina and bladder, three into the lungs, and three probably into the kidney.

Lidell, in an article on rupture of the abdominal and pelvic viscera,* gives a case of gun-shot wound of the right kidney and third lumbar vertebra, where an abscess was formed in the cellular tissue behind the caput coli, which burrowed along the psoas magnus and among the muscles of the abdominal wall and the back, and passing up beneath the right crus of the diaphragm, burst into the right pleural cavity, and in this way caused death. The case is worth quoting, because of the emphasis the author lays upon its being "a matter of the highest importance to secure the *early* discharge of the contents of the abscess through an external opening, since from the looseness of the cellular tissue the pus is apt to burrow widely." Quain and Dickinson have each recorded a case in which the abscess opened at the groin, and in two cases of my own, one of which will be referred to farther on, the same thing occurred. Dr. F. Lange has reported a case where empyema and a sinus on the front of the thigh were both apparently due to a perinephric abscess. Bowditch gives a case of a young man supposed to be dying of phthisis, and who was expectorating large quantities of pus, which from time to time used to pour out of his mouth; but he had also the perinephric posture and lameness, and these led Dr. Bowditch to incise the loin. Matter was reached, and the patient recovered. This is a most striking example of the value of incision.

Of the twenty-eight cases of primary abscesses, recorded by Trousseau and Bowditch (*see* Poland), eighteen recovered, eight died, and in two the result is not mentioned. Of the eight deaths, six were in cases in which no operation was performed, and death was mainly attributed to this fact. Of the only two fatal

* *American Jour. Med. Sciences*, p. 356; April, 1867.

cases in which the abscesses had been opened, one died of peritonitis, quite independent of the disease, and one from hectic and diarrhœa.

A case in several ways unusual came under the care of Dr. Coupland and Mr. Lawson in the Middlesex Hospital, on January 6th, 1883. A boy, aged thirteen, had suffered for a month from pain in the right renal region, and obstruction in the lower end of the right ureter, probably due to impacted calculus. Pyo-nephrosis followed, a tumour formed in the right renal region, which was opened on February 14th, by a lumbar incision, and a fistulous opening was established in the loin. Suppuration afterwards completely surrounded the kidney and extended downwards, so that an opening was made in the groin on February 27th. This opening communicated with that in the loin; but at the post-mortem no communication existed between the perinephric abscess and the interior of the kidney, nor did the sinous fistula, which led from the pyo-nephrotic cavity to the surface of the loin just below the last rib, communicate with the abscess space around the kidney. During life a fragment of calculus was impacted and removed from the urethra. As pus had been freely discharged through the fistula in the loin, the sacculated kidney had become somewhat shrivelled. The surface of the kidney (the right) was devoid of its capsule, but the lining membrane of its cavity was thickened, and suppurating foci were seen in what remained of the pyramids. The calyces and pelvis were filled with caseous pus. The ureter, which was doubled to within three inches of the bladder, was enormously dilated throughout its whole extent, but its vesical orifice was much constricted. The dilated ureter was filled with the same kind of material as the cavity of the kidney. The perinephric abscess was full of semi-solid caseous material and green fluid pus. There

was empyema of the right side, and pus occupied a space between the diaphragm and the under surface of the

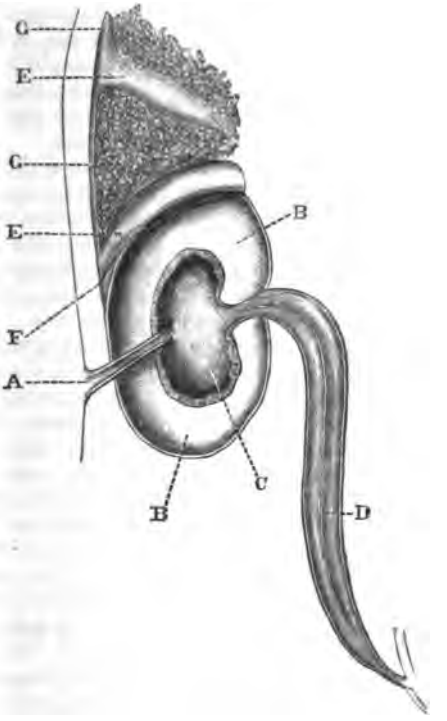

Fig. 16.—Diagram Showing Perinephric Abscess.

A, Sinus opening on surface and into kidney cavity; B, perinephric abscess space; C, abscess cavity within kidney; D, septum in ureter; E, empyæmic space; F, diaphragm; G, lung.

right lung, but there was no communication between this empyema and the perinephric abscess (Fig. 16). The left

kidney was hypertrophied. The course of events in this lad had been, no doubt, first obstruction in the vesical orifice of the right ureter, and then pyo-nephrosis; the pyo-nephrosis gave rise to general suppurative perinephritis; lastly, empyema was set up by the contiguity of the pleura to the perinephric abscess, which was pressing upwards the right side of the diaphragm. Death was brought about by pericarditis, the result, it was supposed, of septicæmia.

The fact that the ureter was doubled throughout the greater part of its course; that the lumbar fistula had, at the time of death, no communication with the perinephric abscess, but opened directly into the sacculated kidney; and that the abscesses connected with the kidney had no direct communication with the empyema, are striking features in this case.

Prognosis.—The prognosis is always grave. The duration of the disease varies from two or three weeks to many months. In a few cases perinephritis ends in resolution before the suppurating stage has been reached. Gibney mentions one such case of six months' duration. When suppuration occurs the prognosis depends chiefly on two things, the early and free evacuation of the pus, and the cause of the disease. Incision not only saves life, but also hastens recovery; and in uncomplicated cases the recovery is complete. The tendency to open spontaneously in the loin is not great in perinephric abscess; the pus is more likely to take some less favourable direction; but even if the abscess bursts externally, it is too often not until after extensive burrowing has occurred, and through an opening not free enough to permit of thorough drainage. Prolonged suffering, hectic, and death, are too generally the results in cases where incision is either delayed or neglected. When the abscess is primary, *i.e.* not dependent upon renal or other visceral or spinal disease, an opening into it is not only followed

immediately by great relief, but convalescence is soon completed.

An incision into the loin by diminishing the tension of the inflamed tissue and allowing of the escape therefrom of blood and serum, has sometimes cut short the inflammation; whilst in other cases it has hastened the evacuation of the pus of a small abscess, the precise spot of which was not struck by the incision. When the perinephric abscess is secondary, and consecutive to an urinary fistula (a circumstance by no means rare in calculous pyelitis, and where there is distension of the pelvis, and calyces of the kidney), the lumbar incision is followed by a fistula which remains open permanently or for a very long time. Sometimes the cure is only completed after many years, and after the discharge of several calculi.

If the abscess burst into the lung, colon, or ureter, recovery may ensue unless the cause of the abscess is incurable; and, at any rate, immediate relief from the local symptoms will be experienced. On the other hand, fresh suppuration may be lighted up by the escape of air and mucus, or by the extravasation of fæces (as in a case reported by Bowditch) or urine into the abscess; and then death may occur from pyæmia, septicæmia, hectic, exhaustion, or gangrene of the lung. Even in cases communicating with the intestine, kidney, or lung, relief, and even permanent and complete cure, might be obtained by lumbar incision. Hufeland* describes a case in which a pin, swallowed by mistake, perforated the ascending colon and led to the escape of fæcal matter and gas, and thus to a considerable abscess in the right lumbar region. The patient died in spite of a lumbar incision. But, he adds, these abscesses do not always terminate so; and he then describes a similar case of fæcal abscess in the left loin of a man, aged forty, which entirely healed

* *Vide* Rayer, p. 247.

after it was opened and drained. Nieden mentions a case of cure after an abscess of the perinephric tissue had burst into the lung, and eighteen ounces of pus had been expectorated.

If the abscess bursts into the peritoneum, death from peritonitis will in all probability quickly follow; if the abscess bursts into the pleural cavity, empyema will carry off the patient. Death sometimes is caused by the pressure effects of the abscess before it is opened or has ruptured. Syncope, apnœa, and other chest complications, are very common in perinephric abscesses, as well as in subdiaphragmatic abscesses within the peritoneal cavity. When scrofulous disease, or complete disorganisation from calculous affection of the kidney is the exciting cause, nephrectomy may afford the only chance.

In cases in which complete cure is impossible, and a permanent pus-discharging fistula remains, nephrectomy may be the only chance of warding off lardaceous disease; but, of course, this operation applies only to cases in which the cause of the abscess is in the kidney itself.

Diagnosis.—In examining a case of probable perinephritis or perinephric abscess, we have to ask ourselves *first*, how to distinguish it as such; *secondly*, whether the perinephritis or abscess is primary, or secondary to renal or some other organic disease; and *thirdly*, in cases where the inflammation or abscess is very limited in extent, by what signs can we precisely localise the seat of disease?

1. *The affections which may be mistaken for perinephritis or perinephric abscess*, are lumbago, nephralgia, various organic diseases of the kidney, spinal caries, perityphlitis and perityphlic abscess, splenic and hepatic tumours, fæcal accumulations in the colon, empyema, pneumonia and abscess of the lung, typhoid fever, morbus coxæ, and psoas abscess.

In the early stages and in mild cases an exact diagnosis is not always possible. The following indications will, however, assist us in most cases.

Lumbago is unaccompanied by fever, local swelling, or marked tenderness on pressure; the pain is felt on both sides of the spinal column, does not extend around to the front of the renal region, nor shoot along to the groin or testis, and though it is aggravated by movements of the back, it does not cause spasmodic contraction of the psoas muscle; there is tenderness of the muscles and fascia on *pinching* those structures. Though the patient walks with a stoop and with a rigidity of the spine, there are not the flexed thigh and lateral inclination of the trunk which are seen in perinephric abscess and perinephritis.

In *nephralgia* the pain is periodic, paroxysmal and variable in degree, sometimes being almost or entirely absent, and sometimes intense; it is generally increased by fatigue or nervous depression, and in women during menstruation; it is unattended by alteration in the urine, and does not often shoot along in the direction of the ureter. There are tender spots in the loin which are made more so by pressure; and there may be irritability of the bladder; and neuralgic pains similar to those in the region of the kidney may be felt in the testis, in the opposite loin, or in any other part commonly affected by neuralgia. The fulness, hardness, and wide-spread tenderness, the continuous and daily increasing pain, the sensation of tightness and puffiness felt by the patient, and the flexion of the thigh so common in smart attacks of perinephritis, are all wanting in neuralgia.

Organic diseases of the kidney, such as cancer, tubercle, calculus, pyo-nephrosis, and the various cystic diseases of the kidney, may co-exist with (having, in fact, given rise to) perinephritis. The

diagnostic characters of each of these will be described under their separate headings or in the chapter on renal tumours, and need not be repeated here. It will be sufficient to state that pyo-nephrosis and renal cysts, though they may give rise to elevation of the general temperature of the body, do not cause an increase in the local surface heat nor œdema of the superficial tissues of the loin, nor is the tumour in these cases so ill-defined in outline as it usually is in perinephric abscess; and fluctuation, when it can be detected, is deeper than when the pus is outside the kidney.

Disease of the spinal column.—The similarity between some cases of perinephric abscess and disease of the vertebral column is very striking; and Dr. Gibney records a case in which the spinal brace had been ordered for a patient with perinephritis running on to perinephric abscess. In spinal caries the pain extends round the trunk, and is often most felt over the pit of the stomach; it is relieved by suspending the patient; there is a sense of weakness in the centre of the back corresponding to the seat of affection; and there is increased sensibility to heat, so that the patient winces on the application of a hot sponge to the spine. The body is held stiff, with the spinal column straight, and the shoulders raised; there is no inclination or rotation of the trunk to one side as in perinephritis. The flexibility and mobility of the spinal column is lost, and the spine moves as a whole upon the hips.

As the disease progresses the patient cannot stand upright unsupported, the body is bent directly forwards, and is in fact supported by both hands resting on the thighs or on a chair or table; not by the hand of the affected side resting on the thigh of the same side as in perinephric disease. There is difficulty in standing on one leg. The walk is shuffling and

tottering, and the toes are more or less turned in. After a time one or two of the spinous processes may become a little prominent; and tenderness or pain will be elicited by pressure or percussion over this part of the column; and often, too, by pressing on the head or shoulders whilst the patient is sitting on a firm seat. When the disease has advanced to distinct deformity of the spine, with great weakness and more or less palsy of the muscles of the lower limbs, of the sphincter ani, and detrusor fibres of the bladder, there is or ought to be no possibility of mistaking spinal disease for perinephritis.

Perityphlitis and typhlitis.—The characteristic symptoms are pain, tenderness, and swelling in the right iliac fossa. There is the same insidious onset often, the same severity of onset at other times as in perinephritis. There is the same description of pain, aggravated by coughing and movements as in perinephritis. There is the same inclination of the trunk to the affected side, and the same flexion of the thigh of that side; both with the same object, to relax tension and pressure upon the inflamed structures. There is the same tendency for the pain to shoot downwards into the thigh, and the same occasional numbness of the thigh as in perinephritis. There is the same gradual increase of swelling, hardness, redness, and at last, perhaps, positive tumour, sometimes excited by similar causes, and often terminating in similar ways; and whereas perinephric suppuration is prone to spread downwards into the iliac region, perityphlic suppuration is nearly equally prone to burrow upwards into the loin. They may each give rise to œdema of the lower limb.

The great and distinctive difference is that in perinephritis the pain, tenderness, and swelling are first and chiefly in the ilio-costal interspace behind; whereas in typhlitis and perityphlitis they are in the

iliac fossa. In both alike there may be marked constipation, or alternations of constipation and diarrhœa; but constipation is usually more obstinate in typhlitis, and may be associated with stercoral vomiting. When peritonitis is an early symptom, and comes on without collapse and before pus has had time to form in the cellular tissue, the probability is all in favour of typhlitis.

When all the symptoms are referable to the left side, typhlitis is of course excluded; but the same inflammatory changes occur in and around the sigmoid flexure as around the cæcum, and occasionally those around the sigmoid are secondary to typhlitis. This should be borne in mind when the left side is affected.

Fæcal accumulations give rise to pain, constipation, neuralgic affections of the thigh, and hardness and swelling of the abdomen; but they are removable by aperients and enemata, are rarely associated with fever, though the temperature may rise from time to time; and are unattended by the flexion of the thigh and lateral inclination of the trunk.

Splenic and hepatic tumours, if we except abscesses, form without causing fever, and often painlessly. They have a more anterior situation and are more defined in outline, and move freely up and down in respiration. The pain, numbness, and flexion of the lower limb are wanting.

Empyema, pneumonia, and abscess of lung will be recognisable by their usual symptoms; but when secondary to perinephritis or perinephric abscess, as they sometimes are, the flexion of the thigh and other local symptoms of inflammation of the tissue about the kidney would be noticeable. Dr. Bowditch gives a forcible illustration of this fact. It should always be in the mind of the surgeon, because cure may follow from prompt and judicious treatment.

Typhoid fever.—The insidious onset of typhoid

as of perinephritis, and the fact that occasionally both are masked by pneumonia, will show the wisdom of withholding an opinion, in certain cases, for a few days; but in typhoid there are no evidences of local inflammation, and there will soon come the characteristic temperature and tongue, the rose spots, the tumid abdomen, and the enlarged spleen; whereas in perinephritis there will be evidence of local inflammation with the absence of the above-named symptom.

Morbus coxæ.—Perinephritis ought to be distinguished from disease of the hip by two classes of symptoms, positive and negative. The positive signs of perinephritis are the higher situation of the pain; the tenderness, if not fulness, and other changes in the loin; the fact that passive flexion is not only painless of itself but often relieves existing pain, and is effected without any movement of the pelvis; and further, the free and painless mobility of the hip joint in the direction of rotation outwards and abduction whilst the limb is flexed.

The negative symptoms are the absence of fulness about the hip joint, and of tenderness on pressure over the head and trochanter of the femur; the absence of pain on percussion of the thigh and the less rigidity and spasm of the adductor and rotator muscles of the thigh.

The symptoms of perinephritis which suggest hip joint disease are the pain in the thigh and occasionally in the knee, the flexion of the thigh on the trunk and of the knee on the thigh, the inability to completely extend the thigh without causing pain and tilting of the pelvis, and the peculiar inclination of the trunk and the limping walk. In cases in which the pus burrows downwards and opens below Poupart's ligament the simulation is even more complete.

The following is a case strongly in point. On

March 11th, 1884, I was asked to see a boy seventeen years of age, who was said to be suffering from left hip joint disease. The only history obtainable was, that nine weeks before this date a small lump the size of a filbert appeared in the left groin, which became painful and burst after poulticing for two weeks; then it slowly healed, and the patient got about with this hip bent on the trunk and the trunk inclined over to the left side. Soon, however, the swelling in the groin again increased and a little pus was discharged through the old wound. When I saw him the lad was lying on his back but inclined considerably over on his left side, with his thigh bent up on his abdomen and his leg on his thigh. He was emaciated, anæmic, and apparently in much pain. There was a red, inflamed, and slightly elevated swelling in the left groin, hot and tender to the touch. There were fulness and tenderness in the left loin as well as above Poupart's ligament. The temperature was 101°. He had had rigors and sweatings. There was no pain on moving the hip during flexion, and no pain on crowding the femur against the acetabulum. I diagnosed perinephric abscess, and advised immediate incision into the loin. This was to be done the next day; but during that night the abscess burst in the groin and discharged about one pint of thick greenish-yellow pus of slightly fœtid odour. His pain was immediately relieved. Still, adhering to my diagnosis, I made an incision into the left loin with the view of giving more direct exit to, and providing better drainage for, the pus. Eight ounces of thick greenish-yellow pus escaped. A probe was introduced at the loin incision and passed without obstruction downwards for fourteen inches through the obturator foramen, and its extremity was felt on the inside of the thigh amongst the adductor muscles. No bad symptom occurred afterwards, the temperature never rose higher

than 100·4°; he rapidly gained flesh, and within six weeks was perfectly recovered. The rapidity with which the flexion of the thigh ceased was very striking; within a few days after operating, the ham could be made to touch the bed easily and without pain.

Though caution is required to arrive at a right diagnosis; and though Gibney may be right in thinking that many reported cases of hip disease followed by recovery with perfect mobility of the joint, are in reality cases of cured perinephritis, yet such a mistake ought not to be made, and will not be if due attention is paid to the positive and negative signs mentioned above.

Inflammation and abscess of the psoas simulate perinephritis in the following points: pain, inability to stand upright, and lateral inclination of the trunk to relax the muscle and to extend the leg. If, however, there be suppuration due to caries of the vertebræ, there will probably, though not always, be the symptoms of disease of the spinal column, and an examination of the evacuated pus may show evidence of disintegrated bone. Further, the situation of the pain and swelling in psoitis will be much nearer the middle line than in perinephritis. In perinephritis the local symptoms show themselves in the loin and on the side of the abdomen posterior to a line drawn from the front border of the axilla to the crest of the ilium. If the psoas abscess is large, it will descend below Poupart's ligament in the line of the psoas muscle. Psoas abscess is not always due to spinal caries, but the course and determination of the pus will be independent of the cause of the abscess.

The case of the boy above described shows that a perinephric abscess may burrow into the thigh and present a swelling in the groin; but in that case the matter did not pass along the psoas muscle and beneath Poupart's ligament, but took another course and

reached the thigh below the horizontal ramus of the pubis.

A perinephric or a renal abscess may, however, ulcerate into the sheath of the psoas, and then the matter follows the course of that muscle; conversely, a psoas abscess may break into the ureter and discharge itself with the urine.* Thus a perinephric abscess may be the cause of a psoas abscess, or a psoas abscess may either give rise to purulent urine or burrow amongst the perinephric cellular tissue of the same side.

In the following case a psoas abscess on the left side was followed by a perinephric abscess on the opposite side; both were due to caries of the lumbar vertebræ, of the existence of which there was not the slightest evidence before the diseased bone was actually touched by the finger introduced at the lumbar incision.

Case.—J. P., a labourer, of robust and healthy appearance, aged 40, came under my care on April 28th, 1884. For three months previously there had been a "lump" in the *left groin* not larger than a marble, which, having increased, had been aspirated before admission. Further swelling following, the abscess, for such it was, had been opened and a drain tube inserted. There was no injury or other ascertainable cause for the abscess. By July 13th the sinus still continued to discharge pus, and it was now discovered that besides passing upwards beneath Poupart's ligament it burrowed far down into the *left thigh*, so that a counter opening was made on the inner and posterior aspect of the thigh. On August 24th he complained of back-ache, like lumbago, but there was no tenderness over the spines of the vertebræ, and, in short, no evidence of disease of the spinal column.

* Dickinson's "Renal and Urinary Affections," vol. iii., p. 670.

On September 8th there were clear signs of inflammation in the *right loin*, and perinephritis was diagnosed; by the end of another week bulging and fluctuation in the right loin were present; and on the antero-lateral aspect the abdominal walls from the eleventh rib to three fingers' breadth above Poupart's ligament were swollen and hard. On September 17th a free incision was made into the *right loin*, and one and a half pints of pus evacuated. The finger introduced into the wound detected caries of the body of the first lumbar vertebræ, and of the front surfaces of the right transverse processes of the second and third lumbar vertebræ. It was found that injections of water passed from the opening in the right loin to that in the left groin. At the present time (June, 1885) the patient goes about in a poroplastic jacket with both sinuses open, but discharging only a few drachms daily.

Blood extravasation.—After a contusion or other injury blood may be extravasated into the circumrenal cellular tissue in sufficient quantity to give rise to swelling and pain. The diagnosis would be made by the swelling coming on soon after an injury, and by the presence of ecchymosis or other evidence of violence, and by the absence of local or general signs of inflammation; there may have been shock or collapse at first, and later on hæmaturia from hæmorrhage into the pelvis or calyces of the kidney. Extravasated blood, if not quickly absorbed, may give rise to perinephritis, and break down, forming a suppurating swelling; in this event the symptoms of perinephric abscess would succeed to those of extravasation of blood.

2. Having arrived at the diagnosis that the case is one of perinephric abscess, the next question which the surgeon will want to satisfy himself upon is as to whether it is *primary or secondary; and if secondary,*

whether the primary affection is renal, or of some other organ or structure than the kidney. In deciding this question the clinical history of the case will be all important. The history of a blow or a strain, exposure to damp or cold or to some special source of blood poisoning, over-fatigue, the depressing influence of a continued fever such as typhoid or typhus; together with the absence of any preceding symptoms such as would have been caused by renal calculus, renal tubercle, etc.; and also the absence of any sign of disease of the liver, spleen, colon, or cæcum, or of disease of the spine; would point to the primary nature of the abscess, and would encourage a favourable prognosis.

On the other hand, when attacks of nephritic colic, the passage of pus or blood in the urine, the development of a tumour in the flank, or the symptoms of spinal caries, of typhlitis, of caries of the ilium or sacrum, or of empyema or of any other affection which may have given rise to retro-peritoneal suppuration, have preceded the symptoms of perinephritis, then we may be fairly sure that the abscess is secondary, and the prognosis will depend upon the cause of the abscess.

The primary abscesses often come on without any definite cause, and in persons apparently in good health.

If the pus of a perinephric abscess has an odour of urine, it will indicate not only the secondary character of the abscess, but that a renal fistula communicates with the abscess. If the pus has even a strongly fæcal odour it does not necessarily indicate an intestinal origin of the abscess; some quite simple perinephric abscesses have contained pus, the stench of which is only equalled by that of ischio-rectal and various fæcal abscesses.

The escape of intestinal gas or of liquid fæces

would of course point to a communication with the bowel. Such a communication is nearly always with the colon, but occasionally with the cæcum or duodenum. Renal calculus is such a common cause of *consecutive* perinephritis, that the kidney should always be examined and a calculus searched for when an abscess in the circumrenal cellular tissue has to be opened.

3. *How can the precise seat of a small abscess be localised?* As a small abscess in the perinephric tissue sometimes causes severe symptoms, and if left unopened is prone to spread, it would be well if we could with precision exactly localise it. Dr. John B. Roberts, of Philadelphia, has made some elaborate and ingenious suggestions with this view, and has given a table of symptoms for all anterior and all posterior regions; dividing each aspect of the kidney into upper, middle, and lower tracts. As, however, these diagnostic symptoms are purely theoretical, based mainly on anatomical consideration, and needing the corroboration of actual cases, I shall not attempt to follow his description in detail. Moreover, perinephric abscesses in front of the kidney are very rare. The following points having reference to both anterior and posterior regions, though more especially to the latter, may probably assist us in localising a small abscess with tolerable precision.

Perinephritis occurring *in the upper tracts* is likely to be complicated by pleuritic friction, pleural effusion, empyema, expectoration of pus, and dyspnœa; *in the middle tracts* by suprapubic, scrotal, or vulvar pain or anæsthesia, through the ilio-hypogastric and ilio-inguinal nerve; œdema of the scrotum, or varicocele of the left side through obstruction in the renal and thereby in the left spermatic veins; and albuminuria and partial uræmia and suppression of urine due to renal congestion from pressure on the renal vein.

Pain in the groin and scrotum with albuminuria coming on in the course of the inflammation would strongly suggest the posterior middle tract. *In the lower tract* flexion of the hip, pain, or anæsthesia of the front, inside, or outside of the thigh through the influence of the external cutaneous, anterior crural, or obturator nerves, retraction of testicle, pain at knee, scrotal or vulvar pain without albuminuria, œdema of leg of the affected side, and pointing of abscess in the groin, would be the signs.

In deciding upon the line of incision after making a diagnosis as to the locality of the abscess, the anatomical relations of the kidney to the surface of the trunk as given in chapter i. must be borne in mind by the surgeon.

Treatment.—Primary perinephritis may be sometimes checked in its early stages by local blood-letting by means of leeches or the cupping glass, and by hot baths, and hot emollient poultices or stupes. When the acuteness of the symptoms has passed, or the inflammation is of the subacute or chronic character, absorption of the inflammatory products may follow blistering, or hot fomentations applied over some absorbent ointment such as iodide of potash or iodide of lead. The bowels should be well opened at the onset by a brisk purgative, and kept acting moderately by enemata or mild laxatives. Pain must be relieved by morphia given in suppository or by the mouth. The diet should be milk, beef-tea, or something equally simple, and as readily digested. As soon as the presence of pus is suspected it should be at once searched for with the aspirator, or by an exploratory incision in the loin. When matter is detected it should be let out through a free opening in the loin. There should be no waiting for fluctuation; the increasing fulness, hardness, and tenderness, and perhaps the commencing redness and œdema of the skin, are ample signs to

warrant, and indeed to demand, an incision. The ancients recognised the necessity of this practice. Fabricius Hildanus * knew its value, and Rayer has again and again insisted upon it. Trousseau pointed out the difficulty of detecting fluctuation, which he says is almost always deep, requiring great experience to detect; but the doughy feel of the lumbar region, the increase of the fever and other general symptoms, and perhaps the œdema of the skin in the loin, are indications for a free incision which the surgeon must not hesitate to act upon, and with promptitude.

The incision may be either vertical, oblique, or transverse, and after dividing the integument and muscles with the knife, the suppurating tissue should be entered by the finger. The abscess cavity should be examined with the finger and the kidney felt over in search for a stone; and if a renal fistula exists it should be probed if the preceding symptoms indicate calculous pyelitis. Any loose sloughs of cellular tissue should be removed with the finger or dressing forceps. The abscess should be washed out with a solution of iodine or carbolic solution, and a drainage tube should be inserted. The loin should then be enveloped in a large hot fomentation of cotton-wool soaked in equal parts of water and carbolic acid solution (1 in 40); or better still, if there is redness or œdema of the skin, equal parts of lead lotion and carbolic acid solution (1 in 40). Absolute rest in bed should be enforced throughout the convalescence.

Even when no pus exists, if the signs of acute or subacute perinephritis are accompanied by much pain, tenderness, and swelling, much benefit will accrue from the relief of tension which the loin incision

* After describing the incision, Fabricius adds, "Effluxit copiosus humor purulentus et fœtidus. Ab eo tempore mitigata sunt symptomata omnia, et ipsa brevi restituta. Vixit et valuit multos annos" ("Observat. et Curat. Chirur.").

affords; and the wound should be prevented from superficially closing by the introduction of a drainage tube. In certain cases of early incision no pus has been observed to escape at the time, and the surgeons have been disposed to regard the operation as a failure; but it has not been so, for in these cases immediate relief from suffering has been secured, pus has escaped within a short time after the incision was made, and the swelling in the loin has soon melted away. All surgeons must agree with (1) Rayer, who said that when pus is accumulating around the kidney, one must hasten to let it; "the abscess ought to be opened with the bistoury;" with (2) Trousseau, who strongly urged free incision, and with (3) Bowditch, who, in urging the advisability of an early incision, remarks, "if ever there be occasions for a *cautious boldness* on the part of the surgeon, these abscesses present them."

The published records of cases show that this teaching still needs to be enforced: and they afford an ample illustration of the fatality which attends a procrastinating or timid handling of deep-seated suppuration.

Another precaution is needed, and is suggested by some of the recorded cases. Consecutive abscesses, and also some of the less acute forms of primary abscesses which do not soften down very quickly, *must not be allowed to close too early.* On the contrary, the drainage tubes should be retained until, by the granulating process in the wound, they are forced out by degrees. If the wound is allowed to close early in these cases, fresh inflammation occurs and fresh pus is formed, which will need a second incision or run on to some fatal termination by burrowing far and wide.

Hæmorrhage rarely occurs when a free incision is made; and if it does the bleeding will be easily restrained by torsion or ligature. When a fistulous

opening remains, astringent or iodine solutions may be injected, or the hot wire introduced. I have seen a fistula persist in spite of the most persevering measures (including free incision and paring the walls of the fistula) employed to close it.

A lumbar hernia may follow the incision for the evacuation of an abscess, as it may one for the examination of the kidney.

Trousseau warns the surgeon that such a hernia may complicate the diagnosis. I have once seen it result from an exploratory incision in a case of suspected renal calculus.

After the incision is made, and whilst suppuration continues, nutritious food, tonics, and possibly a regulated allowance of stimulants, should be given.

Rayer* quotes a case which shows the length of time that an abscess in the circumrenal tissue, but communicating with the cavity of the kidney, may continue; and how, when it ceases to discharge through an external opening, it may do so through the ureter and lower urinary passages. The patient was a military officer, who for twenty years or more after receiving a wound in the left lumbar region, was subjected from time to time to a profuse discharge of blood and pus through the breaking down of the old cicatrix. After a great lapse of time the external wound became soundly healed, and the matters which heretofore had escaped externally through the reopening cicatrix came away periodically by the kidney and bladder. They caused hæmaturia, preceded each time by symptoms of fever, and sometimes delirium so grave as to threaten the life of the patient for twelve or fourteen days together. An abundant outflow of blood and pus produced a favourable crisis, after which the sufferer soon convalesced and became quite well.

* Vol. i., p. 269.

Such a case as this ought to have been treated by free incision and drainage in its earlier stage, and this failing, lumbar nephrectomy would have relieved the patient from the periodical and dangerous attacks described by the reporter of the case.

The success of early incision and continued drainage has been thoroughly proved. Duffin says that in twenty out of twenty-six cases collected by him, early puncture had been made; and of these twenty, twelve quite recovered; in six others there was "a fair modicum of success," which means that in many cases complete success could not be expected, owing to the character of the exciting cause of the abscess. Poland* tabulated twenty-eight cases of perinephric abscess, which he thought were primitive, *i.e.* not due to pyelitis, calculous nephritis, or such-like causes. In fifteen of these free incision was adopted, and recovery occurred in all but one of them, which succumbed to hectic and diarrhœa. Of eight cases not operated upon at all, six died; in one the abscess burst into the bladder and vagina, and the patient recovered; in the other it burst into the lung, with relief. Of five cases in which the abscesses were evacuated by trochar and cannula, or by caustic potash, one died, two recovered after the evacuation of pus, and in two no pus was detected by the trochar at the time, but pus was discharged subsequently. Of ten secondary abscesses tabulated

* *British and Foreign Medico-Chirurgical Review*, vol. ii., p. 235; 1871.

To avoid the counting of the same cases twice over or oftener, it may be well to point out that Duffin's cases consist of Trousseau's, three of Bowditch's and Gull's, Reed's, Quain's, Dickinson's, Hullet Browne's, Chuckerbutty's, and his own.

Poland's sources are Trousseau 16, Bowditch 10, Bryant's case, and Duffin's, and those Duffin collected, which are not in Trousseau and Bowditch's first paper (May 4, 1868).

Nieden's list includes Trousseau, Bowditch's, Duffin's, and numerous others.

by Poland, the only ones which recovered were three which were operated upon; all those not operated upon died.

LITERATURE.

Rayer; "Traité des Maladies des Reins," vol. iii., p. 244, *et seq.*
Trousseau's "Clinical Medicine" (Sydenham Society's Trans.), vol. v.
Krætschmar; "Des Abscès Perinéphriques." Paris, 1872.
Duffin; *Med. Times and Gazette*, Sept. 24, 1870, and Nov. 16, 1872.
Poland; *British and For. Med.-Chir. Review*, 1871, vol. ii.
Gibney; *Am. Journ. Med. Sc.*, 1877 and 1878; and *Chicago Med. Journ. and Exam.*, 1880
Nieden; *Deutsches Archiv für Klinische Medicin*, Bd. xvii., 1878.
Moxon; *Lancet*, May 1, 1875; Lange: *New York Med. Journ.*, Jan. 27, 1883.
Bowditch; Medical and Surgical Report of the Boston City Hospital, 1870.
Dickinson; "Urinary and Renal Diseases." 1885.
Roberts, J. B., Philadelphia; *Am. Journ. Med. Sciences*, April, 1883.
Lectures by Dr. S. Fenwick, *Lancet*, July 25, and Aug. 1., 1885.

CHAPTER XVII.

TRAUMATIC NEPHRITIS.

THE kidney may become inflamed in consequence of a wound or contusion of its substance, of a wound or contusion of the loin, or even of a violent muscular effort or strain. The inflammation excited by a renal calculus, by a foreign body introduced from without, and by parasites developed within or finding their way into the kidney, must likewise be considered due to a mechanical cause. These latter are amongst the causes of interstitial nephritis and pyelo-nephritis,

forms of inflammation identical with those caused by injuries, and which will be considered in future chapters devoted to the renal affections secondary to disease of or operations upon the lower urinary organs.

When the kidney becomes inflamed after a blow or strain, a contusion or wound, the inflammation may be either primary or secondary, according to the nature of the injury. In other words, the nephritis may occur as a direct and immediate effect of the violence to the kidney itself; or only by extension of inflammation from the perinephric cellular tissue, in which case the kidney may or may not have been injured by the violence.

When blood has been extravasated into the cavity of the kidney, and the urine is retained there because of the impaction of a blood clot in the ureter, pyelitis and pyelo-nephritis may arise as in any other case of obstruction to the outflow of urine.

It is seldom, if ever, that the pelvis of the kidney alone is inflamed as a result of injury. Almost invariably when pyelitis occurs there is also interstitial inflammation of the kidney substance. On the other hand, interstitial nephritis, either of an acute or chronic character, may occur without any of those indications in the urine which mark inflammation of the pelvis of the kidney.

Symptoms.—The onset of traumatic nephritis is nearly always announced by a rigor; then follow thirst, dry tongue, heat of surface, restlessness, and all the other symptoms which characterise the febrile state. The initial rigor may be severe or slight, but it is rarely wanting altogether. Pain in the renal region is not constant in character, and is very variable in degree. That which was due to the original violence may have entirely ceased under rest and treatment; and then, after some days of ease, fresh suffering, often more intense than the first, is felt in the

neighbourhood of the kidney. This pain commonly is only felt over the affected side, but it may involve both, though the injured side more severely.

It is deep-seated, referred to the loin rather than to the front of the kidney; is sometimes circumscribed and limited to a point in the flank, at others diffused over the whole flank, or even extending along the course of the ureter, to the groin or testicle. Sometimes the pain is widely diffused over the lumbar, hypochondriac, and central areas of the abdomen, even in cases in which no perinephritis exists. It may be acute, and increased on the slightest pressure; or of a dull aching character, scarcely, if at all, aggravated by pressure; or so slight and obscure, that only firm pressure, first over one loin and then over the other, brings out the fact that one side is tender and the other not. The pain is seldom of the same intensity throughout, exacerbations and remissions being the rule. It is rarely of a throbbing or plunging character, except when the perinephric tissue also is inflamed. Sneezing, coughing, lying on the affected side, bending the trunk forwards, and nearly all movements of the body, aggravate the pain, and this is more especially the case when perinephritis or peritonitis complicates the nephritis.

Though traumatic nephritis usually involves one kidney only, yet either as the effect of the inflammation of the injured organ, or in consequence of the fever which the nephritis causes, it is not very infrequent to find, after an injury to one kidney, that the amount of urine is greatly diminished or altogether suppressed for a time.

If the disease sets in shortly after the receipt of the injury, the urine always contains a trace of blood, sufficient sometimes to give a brownish or red tint to the urine. When the blood ceases, the urine, though it looks natural, continues to be albuminous for a time

longer. Later on pus in small quantity may be found in the urine, but this is not usually the case; and when it is found its presence indicates that the suppurating area of the renal substance communicates with the cavity of the kidney, or, what is comparatively more probable and frequent, that the mucous membrane of the pelvis and calyces of the kidney is involved in the inflammatory process. In many cases in which, at the inspection after death, suppurating foci are found in the cortical and medullary parts of the kidney, the urine during life was free of pus. The presence of pus, therefore, means pyelitis as well as nephritis, or else that an abscess formed in the renal substance has broken into the pelvis or into a calyx of the kidney.

The reaction of the urine in nephritis, uncomplicated with disease of the lower urinary track, is acid; or it may be neutral from excess of blood or pus.

The cessation of the pain in the loins, and of the feverish symptoms, and the return of the urine to its natural quality and quantity, indicate the termination of the inflammation by resolution. The persistence of pain and fever, the irregular occurrence of rigors and elevations of temperature, the frequency and smallness of the pulse, the sallow skin, emaciation, vomiting, the development of cerebral or typhoid symptoms, point to the termination by suppuration in the kidney substance. The presence of pus in the urine does not necessarily mean that the inflammation of the kidney substance has gone on to suppuration; in the large majority of cases it signifies only that pyelitis has been engrafted upon a non-suppurative interstitial inflammation.

When perinephritis follows an injury to the loin and is itself followed by nephritis, it is generally very difficult, if not quite impossible, to be sure as to the time at which the inflammation reached the kidney.

Sometimes, but by no means always, the commencement of the nephritis is marked by a decided diminution in the amount of urine excreted.

When perinephritis terminates in perinephric abscess, it is often not clear whether the kidney is or is not involved, though it is easy to diagnose the extra-renal abscess by the swelling, and œdema, and throbbing pain in the loin.

An occasional result of injury to the loin or kidney is the discharge of a quantity of red sandy deposit with the urine. This has long been known and described as one of the consequences of an accident involving the renal region; but quite recently M. Verneuil* has drawn attention to the fact that the urine of patients who have sustained injuries of, or undergone surgical operations upon other parts of the body, sometimes exhibits a rose-coloured deposit of a peculiar material easily recognisable with the naked eye as it adheres to the urine glass. It is a transient condition lasting only two or three days, and comes on soon after the injury. These deposits indicate, so M. Verneuil considers, a tendency to secondary hæmorrhage, and gangrene after injuries. The nature of the pigment has not been ascertained, but its origin has been supposed to be in some way related to hepatic disease. It does not seem to be a consequence of traumatic nephritis.

Cæsar Hawkins† reported a case of a man, aged forty-six, who on January 26th, 1829, fell from a height and severely injured both loins. Three days afterwards he had pain in the right renal region extending to the groin, and pain on micturition; in his urine, which was excreted in ordinary quantities, there was a red sand which made the urine turbid, and became deposited on the sides of the urine bottle;

* *La France Médicale*, May 2, 1885.
† *Lon. Med. Gazette*, tome iii., p. 399.

the urine was, when voided, strongly acid; it contained no blood. There was no fever and no constitutional disturbance. It seemed evident that the fall had deranged the functions of the right kidney, and thence also those of the opposite organ.

The observations of M. Verneuil seem to give a wider application to the fact noticed and recorded by Mr. Hawkins, and are of special interest and importance, if it should be found that this condition of the urine indicates a tendency to secondary hæmorrhage or the sloughing of the wound in persons who exhibit it. The subject is one that needs further attention.

Another important fact connected with traumatic nephritis is the disposition to the formation of renal calculus, gravel, and, in consequence, to renal colic, after wounds, concussion, or severe shakings of the kidney. A clot of blood, derived from traumatic hæmorrhage into the renal pelvis, has not unfrequently formed the nucleus of a renal calculus; but there is no doubt at all that acute and chronic inflammation of one of the kidneys, quite apart from the presence of blood clots in its pelvis, has been an occasional cause of urinary concretions.

Pathology.—In traumatic nephritis, especially after rupture of the kidney, plastic lymph, not pus, is often the product of the inflammation. Such deposits are seen in the fibrinous cicatrices formed in kidneys injured during the life of the patient. Reference has been previously made to such specimens in the chapter on subparietal injuries to the kidney.

In other cases, a great part or the whole of the renal substance is transformed into a soft semiliquid pulp, as in the case mentioned previously where a large calculus occupied the cavity of the injured organ. This change, however, very rarely occurs in a kidney which was not considerably diseased before the infliction of the injury.

When perinephric abscess has complicated or preceded the nephritis, some or other of those pathological changes described under perinephric abscess will be observed. It is common in such cases for the pus to find its way between the muscles of the abdominal wall and burrow far and wide before any distinct fluctuation or pointing is formed.

In other cases of traumatic nephritis, the kidney will be found in one or other of the conditions described in pyelo-nephritis, and interstitial nephritis.

Prognosis.—As a rule, traumatic nephritis is not fatal, and often not even serious in its course or consequences, provided that the damage inflicted on the kidneys by the injury is not great, and that the large vessels are not ruptured. The inflammation, under these circumstances, yields readily to treatment, and the duration of the attack is completed in from ten days to a fortnight.

Treatment.—If the cavity of the kidney has been opened by a penetrating weapon, the urine will drain away through the external wound; but if by a subparietal laceration or rupture, the chief danger, when the large vessels are uninjured, is from infiltration of urine into the cellular tissue, then it may be necessary to lay open the loin by a free incision down to the injured kidney, so as to provide for the free drainage of the extravasated urine and the inflammatory products.

In cases where little or no extravasation of urine occurs it will be only necessary to apply cold or leeches at once; to restrict the diet to fluids in small quantities and of a bland character; and to relieve the lower bowel by one good purgative dose or by an enema. After the first twelve or eighteen hours more leeches will be needed if the pain and feverishness continue; or if vomiting and other symptoms suggest the extension of inflammation to the peritoneum. The leeches

should be applied upon the most tender spot. Opium or hyoscyamus, in doses sufficient to allay pain, should be given internally.

Later on, when pus appears in the urine, and when fever has diminished, but the pain and tenderness in the loin continue, warm fomentations over the whole renal region, warm baths, and a very restricted and entirely fluid diet, should be prescribed.

Sometimes peritonitis will complicate traumatic nephritis, but this is only an extra reason for enforcing more thoroughly the line of treatment just outlined.

When nephro-lithiasis or renal calculus follows traumatic nephritis, the treatment requisite depends on the character of the calculous formation, which is occasionally uric acid but much more frequently phosphatic. (*See* chapter on calculus.)

The symptoms, diagnosis, pathology, and treatment of traumatic nephritis are so mixed up with those of contusion and wounds of the kidney, and with those of the affection of the kidney secondary to disease in the lower urinary organs, that to give a more detailed account of them here would only be to repeat much of what is stated in the chapters on these subjects.

CHAPTER XVIII.

URINARY FISTULÆ.

Urinary fistulæ are of many varieties, and might be classified: (1) as to the part of the urinary system with which they communicate; (2) as to the part of the surface at which they establish an opening; (3) as to their causes; and (4) as to their characters, namely, as

to whether they are simple, or callous, or attended with loss of tissue.*

Many of the forms of urinary fistula which arise, for example, from stricture of the urethra, disease involving the bladder, or abscess of the perineum, I am not expected to describe here; I shall therefore confine my remarks to fistulæ which communicate with the kidney or ureter. These I shall speak of, no matter where they may open upon the surface externally, or with what viscus or cavity they may communicate within the body.

Fistulæ which communicate with the kidney and pelvis of the kidney.—These may be caused (*a*) by incised, punctured, or gun-shot wounds; (*b*) by injury inflicted during surgical operations; and (*c*) by disease.

The records of military surgery contain many examples of fistulæ caused directly by gun-shot wounds of the kidney, or indirectly by the kidney becoming involved in the suppuration which follows gun-shot wounds of the loins. Stabs, and incised and lacerated wounds in the back and loins, are sometimes followed immediately, or after an interval, by discharge of urine. Nephrotomy for hydro-nephrosis and pyo-nephrosis is liable to be followed by a permanent fistula if the cause of obstruction is permanent, and the remnant of the kidney is not removed by nephrectomy. All traumatic renal fistulæ may be expected to close sooner or later.

Abscess of the kidney, whether due to the irritation of a renal calculus or to tubercular or other form of renal disease, is not an unfrequent cause of urinary fistula in the loin, either by the abscess spontaneously bursting, or owing to the non-healing of the wound if the abscess have been opened by the

* *See* J. A. Jagielski, "De Fistulis Urinariis Adjecta hujus Morbi Historia."

surgeon. The discharge of pus and urine in such cases is often very obstinate, the wound contracting to a certain extent, and then remaining as a chronic, and sometimes even as a permanent fistula.

A renal abscess may open into the colon, and has been known even to open into the stomach. In not a few cases in which the ureter has become blocked, the kidney or its pelvis, as well as the circumrenal tissue, have suppurated, an abscess has opened on the surface, and a urinary fistula has thus been formed.

McClelland, of Pittsburgh, records a case in which two fistulæ formed as the result of obstruction of the ureter by calculi: the first opened in the loin, and gave exit to a calculus, and a sinus continued; four years afterwards a second abscess formed, and was opened in the groin, giving exit to pus and urine. As the excretory function of the kidney remained, the woman's state became very offensive, and she was relieved by, and recovered from, lumbar nephrectomy. This operation has been performed no less than seven times for the relief of lumbar, abdominal, uterine, and vagino-ureteral fistula, and in six cases with recovery.

Renal fistulæ, in the great majority of cases, are caused by calculi in the pelvis of the kidney or in the ureter.

They open in one of several directions, namely, at the loin or groin, into the colon or duodenum, into the pleural cavity or lung, or into the peritoneum.

Generally there is but a single opening into the cavity of the kidney or ureter, and that is upon the posterior aspect; but occasionally there are two or three, or even several openings on this surface of the organ.

It is much rarer for a fistula to open into the peritoneum than in any other direction; but in cases of ureteral obstruction, in which pyelitis has gone on to ulceration, this direction is sometimes taken and

death from acute peritonitis rapidly follows. Exceptionally the escape of urine into the peritoneum is slow, and then a circumscribed collection, limited by adhesions, may be formed.

The right kidney, when the seat of abscess or pyo-nephrosis, may open either into the ascending colon or the duodenum, and when into the duodenum pus and urine may be detected in the vomited matter. Fistulæ of the left kidney more frequently open into the descending colon than those of the right into either ascending colon or duodenum. The kidney is often dilated before the fistulæ form, and in some cases the pyo-nephrosis has attained a very large size before it gives way. In other cases a small renal abscess, or some minute suppurating point in a kidney the subject of pyelo-nephritis, gives way, and is followed by suppuration in the circumrenal cellular tissue, which in turn opens on the surface, or into the bowel, lung, or pleura, and gives rise to an urinary fistula.

The fluid which escapes from a renal fistula is sometimes pus, sometimes pus and urine, sometimes urine alone. It depends upon the condition of the kidney which is involved in the fistula; if the organ has been converted into a scrofulous abscess cavity, then pus escapes; if a pyo-nephrosis from obstruction in the ureter has been the cause, then pus and urine; if a wound of the kidney, either surgical or accidental, or a ruptured hydro-nephrotic cyst has given rise to it, then urine, sometimes many ounces in the day, will be discharged.

The urinous character of the fluid is recognised in some cases by its odour, in others by the deposit of phosphates about the orifice of the fistula, in others by the presence of urea, uric acid, or urates in the fluid; it is also revealed by chemical reaction or microscopical examination. Sometimes there is much

excoriation about the external orifice of the fistula; or a number of unhealthy granulations surround it.

Renal fistulæ which open in the loin may be due to any of the causes named above; calculus, wounds, various form of external violence, parasites, or sloughing of the kidney or its pelvis after distension of the cavity of the organ. La Peyre* related a case in which a fistulous opening communicated with the right kidney. The kidney was transformed almost into a fatty mass, and contained three worms three and a half inches long; three other worms were embedded in the neighbouring muscles, and there was caries of the spine near the pillars of the diaphragm.

Traumatic fistulæ are more easily cured than those which follow disease, or result from the incision and drainage of a renal abscess. There are very few traumatic renal fistulæ which are not closed sooner or later, and generally within a short time. The history of the American war of the rebellion has proved this. So also has the operation of nephro-lithotomy. When a foreign body is impacted in the fistulous track, or within the pelvis of the kidney or the ureter, the fistula may remain open for a very long time; indeed, until after the escape of the foreign body.

There is but little difficulty in diagnosing a lumbar renal fistula from the clinical history and course of the disease, and the characters of the pus or fluid which escapes from the opening.

When a fluid having an urinous odour, or containing urea, uric acid, or urates, comes from a fistula which followed upon an attack of nephritis, pyo-nephrosis, hydro-nephrosis or injury to the kidney, there is no room to doubt. It must be borne in mind, however, that urinary fistulæ in the loin are sometimes the consequence of disease in the lower urinary passages, and communicate with the ureter, bladder,

* *Journ. de Médecine*, tome lxv., p. 375; 1785.

or even the urethra, but not at all with the kidney. A remarkable case of this sort was published by Desault.* There were several fistulæ, some in each loin, following a blow from the fist on the scrotum; and though the patient recovered after a long illness, Desault appears to have had no doubt that these fistulæ opened internally, either into the bladder or urethra.

A remarkable case of renal lumbar fistula is related in the chapter on perinephric abscess. (*See* chap. xvi., page 226, and Fig. 16.)

There are many cases on record of urinary fistulæ communicating with the kidney and opening externally in the loin or the groin, through which calculi have been discharged spontaneously or removed by the surgeon. I have known a few of such cases.

Treatment.—The parts around the fistulous orifice must be kept clean, and free from irritation and from the contact of discharges. Time should be allowed for the spontaneous closure of the fistula, and in many instances the surgeon will not be disappointed.

If, however, the fistula persist, caustics, the hot iron, or an incision, so as to lay open any sinuous track, vivify callous surfaces, or remove spongy granulations or calculous deposits, must be tried.

The injection of iodine solution, besides acting as a disinfectant, will sometimes stimulate the sinus to healthy action. Dilute nitric and nitro-hydrochloric acid in solution have been tried, but without any marked effect. If a foreign body, such as a bullet, piece of bone, particle of clothing, or calculus is keeping up irritation and preventing healing, it should be removed. If the other kidney be sound, and a permanent fistula communicates with a diseased organ, the best treatment is nephrectomy. This operation should be practised in any case in which, all other

* "Œuvres Chirurg.," tome iii., p. 301. 3rd ed., 1813.

treatment having failed, the life of the patient is threatened or his comfort sacrificed. It should, however, be borne in mind, that persons may live long and comfortably, and even in good health, with a lumbar fistula; and that though for a long time urine may have flowed freely from it, the quantity of urine discharged may at length be greatly reduced, or the flow may even cease altogether.

Renal fistulæ opening into the stomach.—A very rare form of fistula has been described between the left kidney and the stomach. Pus, urine, and urinary calculi are said to have been vomited. Such a case is recorded in the Philosophical Transactions (1678, No. 3), wherein a woman, aged twenty-one, after violent nephritic pains and retention of urine, vomited a quantity of coffee-coloured gravel weighing half an ounce, and subsequently passed gravel and small stones by the mouth, rectum, and urethra. Another and very similar case, also in a young woman, is recorded in the *Journal de Médecine.** After an attack of nephritic colic and retention of urine, a calculus was detected by the catheter in the neck of the bladder and was extracted by forceps; on several occasions subsequently, after similar attacks of renal colic, large numbers of small and medium-sized stones were cast up, and others were voided at the anus. Lazarus Riverius† and Fernelius‡ have recorded cases of the sort. Fernelius's observations also include cases of rupture of the kidney; and sacculated and suppurating kidneys opening into the duodenum, the stomach, and large intestine.

There is a considerable degree of uncertainty as to the genuineness of the symptoms and accuracy of diagnosis in these cases of gastro-renal fistula. Rayer said

* Tome xvii., p. 173.
† "Observationes Medicæ et Curationes Insignes," 1646.
‡ "Universa Médicina Pathologia," lib. vi.

he knew of no well authenticated case of such a fistula. In an instance related by him the patient was at length proved beyond doubt to have been an impostor, though Rayer admits that for the time he was completely duped by her. A single woman, aged thirty-six years, was admitted into La Charité Hospital in July, 1836. Nine months previously she had fallen from a height of six feet, and five days after the fall she passed blood in her urine and from the anus, and vomited blood. The hæmorrhages continued for four or five months, retention of urine followed, a tumour formed in the right kidney, the urine became purulent; and on the 4th of October, after seven days of suppression of urine, diarrhœa, bloody stools, and fever, it was stated that the matter vomited tasted, smelt, and gave the reaction of urine.

The tumour in the flank considerably diminished in size, and it really seemed that there had been a veritable discharge of urine by the mouth. It was discovered, however, that the matter said to have been vomited was a composition of urine and particles of food, ingeniously blended by the patient whilst she reclined over the edge of the bed pretending to be vomiting. Nysten* has recorded two cases, both in women, in which urine was proved to exist in the matter said to have been vomited. One of the two women was clearly an impostor. The other was, so Nysten supposed, genuine and above suspicion.

The following case of **gastro-renal fistula** was under my own observation, and the nature of the fistula was verified by post-mortem examination. (*See* Plate I.)

A coachman, aged twenty-six, was admitted, under my care, into the Middlesex Hospital, on November 1st, 1884, with the following history. Eleven months before he had an attack of "inflammation

* Nysten, "Rech. de Physiol. et de Chimie Pathol.," p. 280.

of the bladder," and passed pus both with his urine and motions. Five months afterwards he first felt tenderness, and noticed a swelling in the left loin. Six weeks later this swelling was "larger than his fist," and burst, discharging more than a pint of pus. Four small fistulous openings, one over the last rib in the vertebral groove, and three over the left sacro-iliac region, had since been discharging pus freely. He had been progressively declining in health. On admission he was fairly nourished, but pale and looking ill. All the four sinuses in the back were discharging pus. On exploring the upper opening with a probe, it was found to extend vertically upwards parallel with the spinous processes, farther than the length of the probe; outwards, the probe could be passed for half its length; and downwards it could be made to emerge at each of the openings. It was thus evident that there was a wide separation between the integuments and the superficial surface of the sheath of the erector spinæ muscle. Careful percussion and palpation of the abdomen, and an examination of the chest, disclosed nothing. No diseased bone had been known to exist, and no caries could be felt. The sacro-iliac joint was not diseased. Pelvic cellulitis and circumrenal abscess were considered, but the physical signs of neither could be made out. There was, however, the history of "inflammation of the bladder," and of "pus in the motions," as well as in the urine. The urine, on examination after his admission to the hospital, was found to be of an amber colour, flocculent, faintly acid (1025), containing phosphates, but no free albumen, and pus cells were seen under the microscope. On November 5th an anæsthetic was taken, and two incisions were made, one over the twelfth rib and the other nearly vertically through the upper fistulous opening. A sinus, large enough to admit a probe, led from the subcutaneous space thus

laid open down to the twelfth rib. The rib was not diseased. The probe was prevented from passing farther inwards by it. The surface of the old abscess walls were scraped, and a drainage tube was inserted. Very little blood was lost. The anæsthesia lasted about fifteen minutes. The patient had a good night, and was as well as usual the next morning; but at midday, November 6th, he could not take his food, and was sick, and at 1.20 p.m. he was seized with a rigor which lasted twenty minutes. All the afternoon and evening the temperature continued high, varying from 102·6° to 103·8.° During the evening his bowels were moved six times, the motions being very offensive, and of pea-soup consistence and colour. At 10 p.m., November 6th, I was sent for to see him. Complete anuria was then established. The pulse was small, rapid, and felt with difficulty; hands and feet cold; fingers and lips of a bluish hue. He was very restless, and apprehensive of death; not quite coherent in speech, but asserting positively, in answer to questions put to him, that he had no pain. The abdomen and chest were again examined, but no disease detected. A catheter was introduced into the bladder, *but no urine was withdrawn*, although it was stated that an hour and a-half had elapsed since the bed-pan had been last used. On removing the catheter, about a tea-spoonful of thick and offensive pus ran from it. I next examined the rectum and found it distended with air and a quantity of liquid, and on stretching open the anus there was a free flow, continuing for several seconds, of most offensive pus. It was now no longer doubtful that there was an abscess, involving the kidney, communicating with the sinuses in the back, and opening into the intestinal tract. The man died at 1 a.m. the same night. At the post-mortem examination the left kidney was found embedded in a thick layer of circumrenal cellulo-fatty tissue, from

one and a-half to two inches thick. This was firmly adherent to the fibrous capsule of the kidney. On subsequently laying open the kidney, it was seen to be considerably enlarged and riddled by abscesses, which had dilated the calyces and hollowed out the pyramids (Plate I.). Opening into one of the caseous and suppurating cavities of the kidney at the upper and back part of the organ was a fistulous track, which, by its other extremity, opened into the old superficial abscess space in the loin. By another fistulous track, filled with yellow pus and of the diameter of a crowquill, the left kidney communicated with the left margin of the greater curvature of the stomach. The spleen, as well as the stomach, was closely adherent to the renal mass. The small intestines were not adherent at any point; the descending colon passed over the anterior surface of the kidney mass, but it, together with its mesentery, was freely movable upon the kidney. The colon and rectum contained milky-looking pus, but no communication existed between the bowel and the kidney. A most careful examination of the whole length of the gastro-intestinal tract proved that the only communication which existed between it and the kidney was that at the left end of the great curvature of the stomach. Through this, therefore, the pus which was found in, as well as that which had been passed off by the bowel, must have entered. The right kidney was large, its capsule non-adherent, and its surface smooth and pale. On section the cortex was swollen and very pale, and the pyramids were partly obliterated by the swelling of the inter-pyramidal portions. The whole of the medullary portions were very pale. There was a recent thrombus in one of the large branches of the renal vein.

Dr. J. R. Chadwick * recently read notes of a case of gastro-nephric fistula before the Obstetrical Society

* *Obstetric Gazette*, Cincinnati.

of Boston. In this case solid particles of food were drawn off the bladder by a catheter.

Renal fistulæ opening into different parts of the intestines.—Fistulous communication between the right kidney and the duodenum, though very rare indeed, have been proved to exist. Campaignac supplied Rayer with full notes of such a case, which Rayer has illustrated in his atlas.* The patient was a tailoress, aged forty-five, who had a tumour in the right flank and lumbar region, formed by the distension of the right kidney. At the post-mortem examination it was proved that this tumour, then much collapsed, communicated with the second part of the duodenum by means of a small brownish opening. Two other small fistulous openings, an inch higher than the first, communicated with a pouch, scooped out, as it were, at the expense of the right kidney and liver. Some days before death obstinate vomiting set in, at the same time that the fluctuating and tense tumour began to subside and be less painful. The vomited matter was bitter, of an acrid odour resembling stale urine.

It is possible that some of the cases which have been supposed to be gastro-renal fistula have really been duodeno-renal; and this may have been the case even where renal calculi, as well as urine, have been vomited.

If a tumour of the right flank or loin, associated with renal colic, pus, or blood in the urine, or other symptoms suggestive of renal disease, diminishes or completely subsides after the patient has vomited matter having the taste, odour, and reaction of urine, a gastro- or duodeno-renal fistula would naturally be suspected. If the tumour was of the right side, the duodenum in all probability would be the point of communication with the right kidney; if of the left

* Plate XX., Fig. 1.

flank, the stomach would probably be communicating with the left kidney. Rayer's and Nysten's cases, referred to above, ought, however, to place us on our guard against too readily accepting the diagnosis of gastro-renal fistula even in cases in which the existence of a renal tumour renders such a fistula the less improbable.

A renal fistula may communicate with almost any portion of the intestine, large or small; but those which open into the colon are by far the least uncommon. Instances of renal abscess opening into the colon have been recorded from very ancient times. Rayer, with the remarkable industry with which he worked up the history of the literature of almost all the diseases of the kidney, gives extracts from several ancient as well as, to him, modern authors, who have described such cases. He also himself reports a case of tuberculous abscess of the left kidney which communicated with the colon.

When a communication exists between the large intestine and an abscess of the kidney, a pyo-nephrotic cyst, or a perinephric abscess connected or not with the cavity of the kidney, the subsidence or complete disappearance of the tumour in the flank will be followed by the discharge of pus with the stools. The presence of pus in the stools will be very soon disclosed when the abscess communicates with the descending colon. In the case of gastro-renal fistula related above I found pus in the rectum some hours before death, but I cannot say how long after the establishment of the opening into the stomach. The fistula had certainly existed a long time; and he had passed pus by the rectum eleven months before I saw him. Sometimes the fæces have been noticed to have an urinous odour; but when the whole of the renal substance has been destroyed, and the kidney has been converted into a mere pus cavity, there will be

no trace of urine mixed with the pus discharged through the fistula.

The prognosis of the gastro- and intestino-renal fistulæ is very unfavourable; death generally ensues at an earlier or later period from acute inflammation of the bowel, colliquative diarrhœa, or hectic. Cruveilhier * has put on record the case of a woman who died of hectic fever, the cause of which he was unable to discover during life; but on opening the body he found the two kidneys united and situated in the true pelvis behind the rectum. This double kidney contained a large quantity of pus which had burst into the rectum. Such a case must necessarily be of extreme rarity. In other cases recto-renal fistulæ arise through the formation of a secondary perinephric abscess, the pus from which burrows and bursts into the rectum.

Between an abscess of the kidney or a perinephric abscess which has discharged into the descending colon, and the escape of purulent urine into the rectum through a recto-vesical fistula, it might be difficult to diagnose, if the rectal orifice of the fistula was high up out of reach of the finger. The clinical history of the case would, however, help materially towards a correct opinion, and if gas or fæcal matter was passed by the urethra, as well as purulent urine by the anus, the probability would be greatly in favour of a recto-vesical fistula. Fæces and intestinal gas might, however, be discharged through the urethra after gaining entrance to the urinary passages through an intestino-renal or ureteral fistula.

Renal fistulæ opening into the lung.—These are very rare. Rayer could only find four cases. Three were of the left kidney, and one of the right. An interesting case was that of a locksmith, aged thirty-nine, who was admitted into La Charité in May, 1839.

* "Anatomie Descriptive," tome ii., p. 694.

Eighteen years before he had been operated upon for vesical calculus. Eleven years after his recovery from this operation he suffered pains in the region of the left kidney, and passed purulent urine. These symptoms, however, disappeared, and seven months before his admission into hospital very acute pains again affected the left renal region, and extended along the course of the left ureter. The urine was loaded with pus. Abundant purulent expectoration suddenly occurred on two occasions, and was each time followed by a marked diminution of pus in the urine. Death took place on the 18th of June, and at the post-mortem a communication was found between the bronchi of the left lung and the left kidney, at the upper part of which a small perforation existed which opened through a dilated calyx into the renal pelvis. The fistulous track penetrated the diaphragm at the edge of the left branch of the central aponeurosis, and was surrounded by dense fibrous adhesions, connecting together the posterior surface of the stomach, the spleen, and the upper part of the kidney. The kidney substance was atrophied, and the calyces and pelvis were dilated, and filled with a large branched calculus. A calculus and some pus occupied the fistulous passage between the lung and renal pelvis.

The termination of reno-pulmonary fistulæ is death from hectic, or from dyspnœa and exhaustion due to incessant cough and the expectoration of large quantities of pus. The renal abscess may open (1) at once into the lung, the renal tumour having enlarged until it is in contact with the under surface of the diaphragm, and the lung itself having become adherent to the upper surface of the diaphragm; (2) a long sinuous track, surrounded by adhesions, may extend between the kidney and lung; or (3) a subdiaphragmatic abscess may have formed, and ultimately have broken into the lung. Sometimes the lower lobe only of the lung is

involved, and that only to the extent of some inflammatory thickening around the sinus; or a small abscess may have formed in the base of the lung; in other instances the whole lung is more or less involved, and one or more entire lobes may be transformed into a large abscess.

Treatment.—In all cases of internal renal fistulæ the question of nephrotomy and drainage, or nephrectomy, ought to be well considered. There is little doubt but that some of the cases would never have reached the stage of fistula had proper surgical treatment been adopted in good time. What has been said on this subject under pyo-nephrosis, perinephric abscess, and renal abscess, might well be repeated here. When a fistula has actually formed, nephrotomy and the removal of calculi, hydatids, or a foreign body, if one is present, followed by drainage, may be sufficient to induce a cure. If after a trial of this treatment a cure is not promised, and the patient's condition renders it advisable, nephrectomy ought to be performed.

Renal fistulæ which open into the peritoneum.—In cases where urine, or urine and pus, have been extravasated into the peritoneum, death is, as a rule, so rapid that nothing can be done in the way of treatment. Sometimes the patient dies within twenty-four or thirty-six hours after the extravasation commenced; rarely is life prolonged beyond a few days. When, however, as in rare cases of calculous pyelitis, inflammatory adhesions have formed around the kidney, and the urine is effused very slowly into the circumscribed space, the symptoms of peritonitis are chronic, life is considerably prolonged, and under the treatment suitable for such forms of peritonitis (rest, leeches, anodynes, and warm sedative applications and absorbents) a favourable termination may occasionally be obtained by incision and drainage.

Ureteral fistulæ.—These are generally, though not always, the results of operation wounds. Excepting those cases in which the pelvis of the kidney has been the seat of rupture, I do not know of any instance of traumatic ureteral fistula other than as a result of surgical wound.

The doubtful case recorded by Mr. Holmes* subsequently received from the author another interpretation, namely, that it was a wound of the theca vertebralis.

After prolonged and difficult labour, urinary fistula has arisen from sloughing of or injury to the ureter, and the fistula in some cases has opened into the uterus, and in others into the top of the vagina. In the removal of ovarian and uterine tumours, the ureter has on several occasions been divided, and it would have been well in these accidents if the renal part had been brought out through a wound made for the purpose in the loin of the same side, and its orifice there attached by sutures, so as to be outside the peritoneal cavity. Agnew† mentions a case in which the ureter was accidentally divided in removing an adherent ovarian cyst. The renal end was secured in the external wound, and a urinary fistula formed. The patient lived several months, and finally died of some obstruction in the course of the duct.

The great objection to bringing an elongated cord-like structure out at an anterior abdominal wound is lest it should be a cause of subsequent intestinal obstruction.

This is no theoretical objection, as it has been sometimes stated to be. It has proved itself to be an actual source of danger; and though, like other sources of danger, it is not always followed by evil

* Med.-Chir. Trans., vols. lx. and lxv.

† "Principles and Practice of Surgery," vol. i., p. 376.

consequences, it is a risk to which the surgeon ought not to expose a patient.

It is quite possible to mistake the spermatic vein for the ureter. Once, in removing an ovarian tumour, in a case which was complicated by numerous and difficult adhesions, a long narrow tube tore away from the back of the cyst wall. It looked like the ureter, and I traced it up to the right loin. Further examination, however, proved it to be the ovarian vein.

It has also happened to more than one operator when removing the entire uterus for cancer of the os and cervix, to cut out a portion of the lower end of the ureter, which was thoroughly incorporated with the diseased tissue about the neck of the womb. Under these circumstances, the lower end of the part still connected with the kidney ought to be turned into the vagina and fixed there, and the opening in the peritoneum should be closed by sutures. It has been thought better practice, by some surgeons, to perform nephrectomy, and thereby rid the patient at once of the prospect of a fistula. In six * out of ninety-four published cases of extirpation of the uterus, one ureter has been divided, and in two other cases both ureters were cut across. When cancer affects the cervix of the uterus, and the tissues around are infiltrated, this accident must be often unavoidable, unless some of the infiltrated tissue is left behind. When the disease is quite in an early stage, and situated in the os or fundus, there is little or no risk to the ureter, if care be taken.

I have removed the uterus for early cancer of the os uteri, by the abdomino-vaginal method, without seeing or injuring either ureter. In a very advanced case I had to excise about half-an-inch of one ureter.

It was for an ureteral fistula that the kidney was first successfully removed by the operation of

* Spencer-Wells; Med.-Chir. Trans., vol. lxv., p. 34.

lumbar nephrectomy; and the operator, as is well known, was Simon, of Heidelberg. Out of eight nephrectomies for urinary fistula, seven have been lumbar and one abdominal, the incision in the latter case being that first practised in nephrectomy by Langenbuch, namely, along the linea semilunaris.

Cases in which large urinary cysts, presumably due to wounds of the ureter, have been tapped and followed by renal fistulæ, are described in a previous chapter. (*See* chapter on wounds of kidney and ureter.)

Dupuytren records a case of ureteral fistula opening into the peritoneum, and caused by calculous pyo-nephrosis. It occurred in a young lady who, some time before her death, had had an abscess situated in the left renal region, opened by puncture. She died, after prolonged sufferings, from chronic peritonitis, numerous circumscribed intra- and extra-peritoneal abscesses (some of which were fæcal), and ulceration of the intestinal walls from without inwards at several points. The left kidney was reduced to the condition of a pouch with fibrous walls.

CHAPTER XIX.

ABSCESS OF THE KIDNEY.

Abscess of the kidney is *one of the varieties* of suppurative diseases of the kidney. Its consideration might appropriately find a place in connection with injuries of the kidney, because one of the ordinary causes of renal abscess is injury.

By abscess of the kidney we do not here refer to any of those forms of suppurative nephritis characterised by the development of minute and scattered

PLATE II.

Fig. 1.—Abscess of kidney; not communicating with the renal pelvis.

Fig. 2.—Section of sarcoma of kidney removed by abdominal nephrectomy. (See page 488.)

Plate II.

Fig. 1

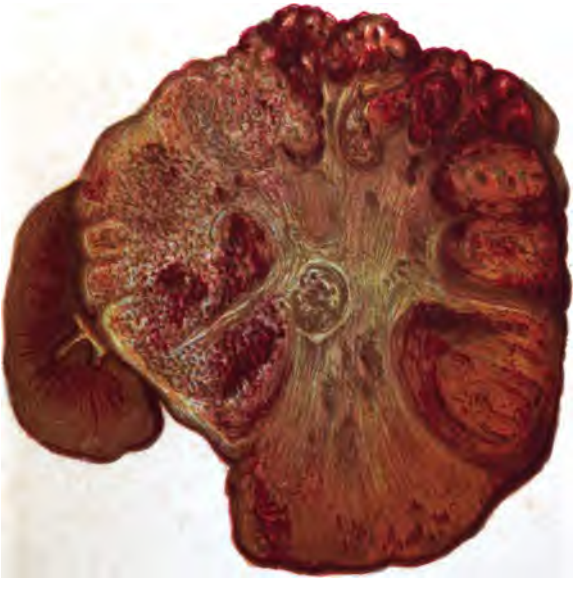

Fig 2

points of pus, the origin of which may be due to (1) some septic material carried into the kidney by the blood; or (2) to some infective matter derived from disease or injury of the lower urinary organs, and passing upwards either by the ureter and uriniferous tubules of the kidney, or by the lymphatics of the ureter and kidney. Nor do we mean to include cases of miliary abscesses due to the irritation of calculous matter in the kidney; to the decomposition of urine in the pelvis of the kidney from the impaction of a stone in the renal pelvis or ureter; or to any other of the numerous causes of obstruction to the outflow of urine. In short, the varieties of surgical kidney or suppurative nephritis, no matter what their cause, are not here classed under renal abscess. Nor is scrofulous kidney included, for it requires to be separately and specially considered. So, likewise, does pyo-nephrosis, *i.e.* suppuration with dilatation of the pelvis of the kidney.

What we have now to describe is that form of suppuration which results in the formation of one or more abscesses of fair or considerable size *in the substance of the kidney.*

Causes of renal abscess as above defined.—It must be stated at once that renal abscess of large size, involving the greater part or even the whole of the kidney, occurs as the result of the fusing together of a large number of miliary abscesses. When the renal tissue intervening between the small miliary abscesses (whether these abscesses are metastatic and due to blood poisoning, or secondary and due to infective material derived from the lower urinary organs), rapidly yields to the suppurative process. these minute abscesses enlarge, and coalesce, until at length the whole kidney may be converted into one large abscess, or into two or three separate abscesses of considerable if not large size. Suppuration of this

kind may be limited to one kidney, the other being quite unaffected.

Metastatic and secondary abscesses of large size may be also formed in another manner, besides that of coalescence just described. Thus, in pyæmia, or in cases of embolism derived from ulcerative endocarditis, instead of a number of minute and scattered emboli followed by minute and scattered points of inflammation and suppuration, one large vessel may be obstructed by an embolus and a large abscess may follow as the consequence.

Mayer reports, in Virchow's *Archiv*, a case of this sort due to ulcerative endocarditis; a large embolus had plugged the right renal artery and led to the formation of a large abscess; numerous bacteria were formed in the pus of the abscess. So in cases of abscess secondary to disease of the lower urinary organs, suppuration may extend by continuity from the bladder along the ureter to the pelvis of the kidney and thence involve the whole of the secreting and tubular parts of the kidney, instead of localised and scattered areas of it. In these last-mentioned cases, however, the pelvis of the kidney and the ureter are ulcerated or sloughy in patches, and pyonephrosis as a rule forms a large feature in the character of the renal suppuration. Sometimes, however, a circumscribed abscess may form in the tubular substance of the kidney as a result of stricture or other disease of the lower urinary organs, as in a specimen in the Hunterian Museum, in which a small abscess cavity with irregular walls followed upon an operation for stone.

Wounds, contusions, and lacerations of the kidney, and kicks, blows, or falls involving the loin or the renal region of the front of the abdomen, are occasional causes of suppuration and abscess of the kidney. Injuries, by causing obstruction in the renal pelvis or

ureter, are especially likely to be followed by more or less suppuration of the renal tissue. Moreover, injury to the kidney, from its tendency to excite the formation of renal calculus in the injured organ, is in this way an indirect cause of renal abscesses of large size. The relationship of injuries to the formation of renal calculi will be further referred to in the chapter on calculus.

A preparation placed by Dr. Bright in the museum of Guy's Hospital shows an abscess of the kidney the result of contusion or laceration of the renal substance. In this case a quantity of pus mixed with coagulum and blood occupied a space between the fibrous capsule and the surface of the organ. The capsule was greatly thickened, in places to the extent of nearly half an inch. The kidney had been injured nine months before death by a blow on the loin.

Rayer reported a case in which the left kidney of a sailor, aged thirty, was considerably contused by falling from a height and striking his left loin against a yard. The symptoms were severe lumbar pain, hæmaturia followed by partial suppression of urine, febrile disturbance of a typhoid character, increasing prostration and frequent shivering. Death occurred a fortnight after the fall; and in the kidney after death there was found about an ounce of thin offensive pus.

I have previously referred to a case of renal abscess followed by perinephric suppuration and caused by a kick on the loin over a calculous kidney. More usually, when renal abscess occurs as the result of injury to the loin, whether attended with immediate injury to the kidney or not, the suppuration of the kidney has been preceded by suppuration in the circumrenal cellular tissue, so that the abscess involves the kidney by spreading to it from without, and is not primarily a renal abscess.

Renal calculus is one of the most common causes of large renal abscess. A calculus which originates in a renal tubule, or one which becomes more or less shut off by inflammatory adhesions from the general cavity of the pelvis of the kidney, is the most likely to give rise to an abscess in the substance of the kidney; calculous pyelitis leading to pyo-nephrosis is the more frequent consequence of the impaction of a stone in the renal pelvis or ureter.

Foreign bodies other than calculi may give rise to a large renal abscess. A piece of bone, or a fragment of clothing, or a bullet, may gain entrance into the kidney, and instead of becoming quietly encysted or passing through the natural channels out of the body it may give rise to extensive suppuration in the organ in which it rests.

Dr. Steven * has described an interesting case in which a bristle, partially encased in a branched phosphatic calculus, was the cause of renal abscess. The specimen was obtained from the body of a man who died soon after sustaining a fracture of the skull. Most of the organs were healthy, but on laying open the right kidney a large quantity of pure yellow pus was found in a series of large cavities chiefly in the upper part of the organ; and lying in the long diameter of the renal pelvis was a long black bristle one and half inches in length and of the thickness of a soda-water bottle wire. The lower end of this bristle passed right through and was immovably fixed in a branched phosphatic calculus which had been deposited round about it, and the branches of the calculus projected into the calyces adjacent to it. The bristle lay exactly in the direction assumed by a probe when passed up the ureter into the pelvis. Dr. Steven considered that it must have obtained entrance into the bladder, and then

* *Glasgow Medical Journal*, p. 187; September, 1884.

made its way up the ureter to the pelvis of the kidney.

Irritant drugs, such as cantharides and turpentine, have been known to cause renal abscess. In the College of Surgeons museum is a kidney in which pus was extensively diffused through the cortical substance and between it and the capsule. This kidney was removed from the body of a man aged sixty, to whom tincture of cantharides had been administered for an incontinence of urine which followed retention (probably due to enlarged prostate). He died in three weeks.

Pathology.—Circumscribed abscess usually affects only one kidney. There may be one, or several abscesses in the same organ. They vary in size from that of a hazel nut or smaller, to that of an orange or larger. These abscesses may or may not communicate with the pelvis of the kidney, or through the capsule with the circumrenal cellular tissue. When they open through the capsule they lead to a circumscribed perinephric abscess, or even to diffused and burrowing retro-peritoneal suppuration. When they open into the renal pelvis they may partially or entirely empty themselves through the ureter and bladder. When two or more abscesses affect the same organ they may or may not communicate with one another. Often they do not. Sometimes one of the abscesses opens into the renal pelvis and the other not. In other cases, two, three, or more abscesses completely separate from one another, will each open by a small aperture into the pelvis of the kidney. This isolation of several abscesses should be borne in mind in performing nephrotomy for abscess. It is not only possible, but very probable, that one abscess only may be opened by the trocar or bistoury; and this should always be suspected when, on introducing the finger within the abscess, its cavity is found closed and narrow towards

the pelvis, and feels to be shut off from the rest of the calyces and pelvis of the kidney (Plate II., Fig. 1).

In a very considerable number of specimens of renal abscess the whole organ, including the pelvis, is involved. The pelvis may be little or much dilated; and the rest of the organ, perhaps greatly enlarged, may be converted into a mere fibrous cyst with large, strongly developed septa or fibrous dissepiments, and with little, if any, renal substance left; that little may be represented by flocculent shaggy ends. It is not easy in some of these cases, especially when the ureter of the affected organ is pervious, and the opposite kidney and lower urinary organs not diseased, to say whether the morbid process commenced as a pyo-nephrosis, or as abscess in the renal substance. It is undeniable that many of the cases reported in the journals and elsewhere as renal abscess are really far advanced cases of pyo-nephrosis.

Symptoms.—These may be either acute or chronic. In the acute cases there is pain in the region of the diseased organ with fever and rigors. The rigors are sometimes marked and frequent; in other cases only one or two occur throughout the course of the disease, and those at uncertain and irregular periods.

Hæmaturia often precedes the formation of abscess when the cause is traumatic.

The absence of pus in the urine is no criterion to go by; in many cases there has been none whatever throughout. In other instances, if the abscess has broken into the ureter or pelvis of the kidney, pus, and it may be in large quantity, will be seen in the urine. If a tumour has been formed in the loin the discharge of pus by the bladder will probably be followed by diminution or subsidence of the tumour.

It is not often, however, that any tumour perceptible during life is formed by a circumscribed

abscess of the renal substance. If a tumour does exist with the history or symptoms suggestive of suppuration, dilatation of the cavity of the kidney may be with fair certainty predicted.

When the abscess is chronic in character, it forms without causing any definite symptoms. Indeed, the abscess may be found at the post-mortem examination without having caused a suspicion of its existence during life.

In some cases, however, general impairment of health, occasional chilliness or rigors, obscure aching in the loin, gradual emaciation and an increasing sallowness or duskiness of skin, indicate some grave disorder, but do not point with any distinctness to its nature.

In the acute cases a fatal termination may occur in from a fortnight to three weeks. The cause of death will most probably be typhoid prostration. Occasionally, however, the abscess bursts into the cellular tissue, the intestine, or the renal pelvis, or ureter, and then life may be prolonged for a time, till exhaustion or hectic terminates it.

Possibly recovery may ensue. In some cases it is pretty certain that the contents of the abscess, instead of escaping in any of the directions mentioned, become inspissated and remain quiescent for the rest of life. What I believe to be a good illustration of this is described by Dr. Bristowe in the fifth volume of the Pathological Transactions (p. 178). A man, aged thirty-one, whose urine, whilst he was under treatment, contained albumen and phosphates, died from congestion and œdema of the lung, and pulmonary apoplexy. In his right kidney, which was small and lobulated, and gave a vague impression of fluctuation, there were found, after death, several cavities varying in size from a walnut to a Spanish nut, filled with an uniform soft but not fluid material, resembling very fine moistened plaster of Paris. These cavities were limited by a

thin fibrous membrane. The putty-like contents presented under the microscope a large number of imperfect broken down cells, like pus cells, a quantity of free granular matter, small oil globules, and a few plates of cholestearine.

From the absence of tubercle elsewhere in the body, and from the uniform character and microscopical appearances of the material, Dr. Bristowe regarded it as concrete pus, the result of bygone suppuration.

Treatment.—The treatment of the early stages of a renal abscess will depend largely on the cause. If it be due to external violence, restricted diet and fluids, rest, anodynes, leeches, or cupping on the loin; the application of an ice bag; and after the first day or two of the inflammation, the constant application of hot fomentations, is the treatment that must be followed. If caused by renal calculus the treatment suitable for the varying phases of this disease will be required. In any case in which there is clear indication of a renal abscess the pus ought to be evacuated through an incision in the loin. It would be quite justifiable in the absence of a tumour, but with the history and symptoms suggestive of suppuration, to make an exploratory incision down to the kidney. If, when the kidney is punctured, pus is found, it is not sufficient to evacuate it with a trocar and canula. A free incision should be made into the abscess, and the wall of the abscess cavity, if a large one, should be stitched to the edge of the wound. For want of such an incision, an untoward result, which otherwise might have been prevented, is but too likely to occur. Several cases might be quoted to prove this; but the following will suffice. Mr. Stanley is reported in the *Medical Times and Gazette* for 1854,* to have punctured

* Vol. ii., p. 342.

an abscess in a kidney after making an incision over it in the loin. The patient shortly died, and in the large renal abscess were found oxalate of lime calculi, which, as the reporter remarks, could only have been reached and removed through a free incision, but which were not even detected by the puncture.

It will occasionally happen, as in the following case, that two or three separate abscesses exist, and an incision into one will not suffice to evacuate the others. When, therefore, the finger enters a space in the kidney which does not communicate with the general pelvic cavity of the organ, or does so only by a small orifice, the rest of the surface of the kidney should be carefully manipulated, or an aspirating needle should be introduced in two or three directions, and if fresh pus is found, a second or even a third incision of the renal substance should be made so as to open the other abscesses. If the kidney is very much destroyed it would be best at once to remove it through the lumbar incision.

Plate II., Fig. 1, illustrates the condition referred to, and although in the particular instance from which this drawing was made the abscess was probably of a tubercular nature, the same condition occurs in abscesses due to calculi and other causes.

The case just alluded to was under the care of Mr. W. Coulson, to whom I am indebted for the history, and for the opportunity of being present at the nephrotomy. On introducing the finger through the incision in the kidney the abscess cavity seemed to be shut off from the renal pelvis. Drainage tubes were introduced, and the wound was dressed antiseptically.

After the operation pus drained away from the wound, and a good deal was daily passed with the urine. The man died from tubercular peritonitis ten days after the nephrotomy.

At the post-mortem examination it was seen that the abscess which had been opened was situated at the lower part and the convex border of the kidney; this communicated by a minute orifice with a second abscess space; a third abscess cavity was formed by the renal pelvis. It seemed that through the nephrotomy wound, the two lower abscesses had been drained; and that after the removal of the pus from them the third abscess had been able to evacuate itself through the ureter and bladder.

CHAPTER XX.

GENERAL REMARKS ON RENAL AFFECTIONS SECONDARY TO DISEASE OF, OR OPERATIONS UPON, THE LOWER URINARY ORGANS.

The kidney becomes the seat of very grave disease, in some instances because of the need of surgical aid; and in others because such aid has been rendered. Because of the need of the surgeon's assistance in cases of obstruction to the natural outflow of urine, there arise all those changes in the kidney which are due to intrarenal pressure, conditions which have been inaptly enough termed "surgical kidney."

Because of the assistance of the surgeon in cases requiring the use of the catheter, or the performance of some surgical operation on the urethra, prostate, or bladder, there occur in some instances one or other of the forms of urinary fever, or uræmia, or renal hæmaturia.

1. **The consequences to the kidney of disease in the lower urinary organs.**—The morbid changes in the kidney which are caused by simple obstruction in the urinary passages; or by

obstruction followed by decomposition of urine; or by decomposition of urine without obstruction, are: (*a*) Hydro-nephrosis, with or without chronic interstitial nephritis, *i.e.* simple dilatation with atrophy, with or without chronic inflammation of the renal substance. (*b*) Pyo-nephrosis; or dilatation with suppuration of the pelvis and calyces. (*c*) Acute and subacute interstitial nephritis. (*d*) Suppurative nephritis and pyelitis; or the two conjoined, that is, suppurative pyelo-nephritis. (*e*) Cicatricial kidney; or one form of granular contracted kidney, the result of recovery from simple or suppurative interstitial nephritis.

(*f*) Septicæmia and pyæmia not unfrequently arise from the decomposition of urine in the bladder, or renal pelvis; but these diseases will only be incidentally referred to in so far as they simulate or complicate the diseases of the kidney.

2. **The consequences, referable to the kidney, of surgical procedures on the lower urinary organs.**—The passage of an instrument along the urethra for the purpose of exploring the bladder, or simply drawing off the urine; or the performance of an operation upon the urethra or bladder, in some instances in which the kidneys are healthy, but more frequently when they are diseased, excites a more or less severe, and a more or less prolonged febrile attack, which has been variously named "catheter," "urethral," "urinary," and "uræmic" fever. The different forms of this fever affect the kidney in very different degrees, but they are themselves largely determined by the pre-existing state of the kidneys. *The varieties of urinary fever* may be classified according to their effect upon the kidney as follows:

a. The congestive; this occurs in a threefold manner.

Fig. 17.—Result of Stricture of the Urethra. The figure shows the effects upon the bladder, ureter, and kidney, of long-standing stricture of the urethra. (From a specimen in the Middlesex Hospital Museum.)

b. The inflammatory; this may be marked either by intermittent or continued fever.

c. The suppurative; which may be marked either by intermittent or continued fever.

In addition to urinary fever, *hæmorrhage from the kidney* sometimes results from the use of the catheter in cases of long-standing retention of urine; and *uræmia without fever* is an occasional consequence of catheterism.

The **inflammatory and the suppurative forms of urinary fever are identical with acute or subacute interstitial nephritis,** and **suppurative nephritis or pyelo-nephritis, respectively.** They are preceded by the same morbid states of the lower urinary organs and kidneys, as have been found by experience to give rise to secondary interstitial nephritis. In fact, and in other words, the two most severe and most fatal forms of urinary fever which follow the use of surgical instruments *are* actually acute interstitial nephritis, and suppurative nephritis or pyelo-nephritis.

Interstitial nephritis and pyelo-nephritis occur also quite irrespectively of the use of instruments upon the lower urinary passages.

The **congestive** forms of urinary fever may be excited by the simple introduction of the bougie or sound in a person with quite healthy kidneys.

It has been well stated by Beck, that "three chief causes are at work in various degrees in the production of secondary renal disease: (1) Increased pressure in the tubules from obstruction to the escape of urine; (2) reflex irritation of the kidney; and (3) the presence of septic matter in the pelvis of the kidney, and possibly in the lower parts of the tubules." Most frequently these three causes act, in succession and in the above order, in the same case. As a rule, when acting singly, increased pressure from obstruction will produce

hydro-nephrosis; reflex irritation will excite one of the transient or congestive types of urinary fever; and septic matter in the pelvis of the kidney will cause acute or suppurative pyelo-nephritis.

Increased urinary pressure alone often produces chronic interstitial nephritis as well as sacculation and dilatation of the kidney; but it rarely, if ever, causes acute or subacute interstitial nephritis. Decomposition of urine in the bladder or pelvis of the kidney may produce suppurative changes in the kidney; and if a quantity of thick tenacious mucus is secreted by the bladder mucous membrane, or if the bladder is rendered very irritable and is thus continually contracting, the lower orifices of the ureters become so much embarrassed that sacculation and dilatation of the kidneys may, in this manner, be caused by simple chronic cystitis no matter what its origin. If the dilatation of the kidney is not complicated by suppurative pyelitis, *hydro-nephrosis* results; if it is so complicated, *pyo-nephrosis* is produced. These facts one sees illustrated over and over again in post-mortem examinations of women who have died of cancer of the pelvic organs. When the ureters are simply compressed or occluded, hydro-nephrosis is found; when ulceration of the bladder has led to decomposition of urine, pyelo-nephritis is almost invariably discovered; when obstruction and decomposition of urine co-exist, pyo-nephrosis is the result.

Reflex irritation alone occasionally excites the inflammatory form of urinary fever, *i.e.* acute or subacute interstitial nephritis; but it cannot, of course, cause hydro- or pyo-nephrosis.

Increased urinary pressure alone, or reflex irritation of a healthy kidney alone, rarely, if ever, excites any form of suppuration of the kidney; but acting together they may do so, as, for example, by the introduction of a catheter into the bladder of a man who had long had

partial retention from an enlarged prostate. Here the catheter sets up reflex irritation of kidneys previously distended, and the result may be suppurative pyelo-nephritis. Herein lies the chief danger of what has been called "the commencement of catheter life" in elderly men with big prostates; and herein lies the risk of using instruments in a bladder affected with calculous disease, or morbid growths of long standing.

The effects of increased urinary pressure, *i.e.* of simple obstruction to the outflow of urine, will be duly described under hydro-nephrosis; and the effects of reflex irritation, under urinary fever; but it is necessary here to say a few words more with reference to the influence of septic matter in the pelvis of the kidney. There are two ways in which the urine may undergo decomposition in the pelvis of the kidney: (1) by direct extension of inflammatory changes from the bladder along the ureter to the kidney; and (2) by the changes in the urine within the pelvis of the kidney when pyelitis from any cause whatever is excited.

1. Various conditions, besides some obstruction to the outflow of urine from the bladder (such as cancer of the pelvis organs, vesico-intestinal fistula, or the bursting of an abscess into the bladder), may excite cystitis, and thus lead to ammoniacal decomposition of urine within the bladder. It is generally thought that this decomposition is determined, very frequently, at least, by the introduction from without of bacteria, and the germs of bacteria, upon dirty catheters or other instruments; and that by the spread of these germs from the bladder along the ureters to the kidney inflammation terminating in suppuration is excited as far as these organisms extend. Even in cases of pyelo-nephritis, in which, though fœtid urine is present in the bladder, the ureters are not inflamed, it is believed by Klebs and others that bacteria have migrated to the pelvis and calyces of

the kidney, there to produce their destructive changes. Hence the name "parasitic nephritis and pyelo-nephritis" proposed by Klebs.

Dr. Lindsay Steven, in a thesis on the pathology of suppurative inflammations of the kidney, published in the *Glasgow Medical Journal* for September, 1884, corroborates Klebs' views, and expresses a very decided opinion that *organisms* are at the root of the formation of all multiple renal abscesses consequent on disease of the lower urinary passages. He, however, considers that there are two ways whereby the "particulate virus" obtains access to the kidney, and sets up suppuration in many different points; namely (1) by means of the uriniferous tubules, and (2) by means of the lymphatics of the ureter and kidney.

Dr. Steven shows that the lymphatics, quite independently of any other channel, may form the pathway of the virus from the bladder to the kidney.

He admits that the two ways may be more or less combined in many cases; so that multiple miliary abscesses may originate in the same kidney, partly by the inroad of micrococci along the ureter and uriniferous tubules, and partly by their inroad along the lymphatic tracks of the kidney.

Mr. Marcus Beck,* while he recognises that the lymphatics are involved in suppurative nephritis, also holds that the septic material first passes into the uriniferous tubules. Mr. Beck is of opinion that probably in all cases slight catarrhal pyelitis, set up by obstruction in the lower urinary passages, precedes the decomposition of urine in the pelvis of the kidney; and that as soon as the decomposition of urine occurs the pyelitis is greatly aggravated by the ammoniacal urine. The share played by the lymphatics in suppurative nephritis he explains thus: "The pelvis of the

* Reynolds' "System of Medicine.

kidney, and probably also the straight tubules for a greater or less distance, are filled with putrid urine at some degree of pressure. The contact of this irritating fluid damages the epithelium, and causes its rapid desquamation. The septic matter then passes readily through into the intertubular lymph spaces of the kidney, and excites a diffuse inflammation which spreads rapidly towards the cortex between the tubules."

Dr. Steven, on the other hand, considers that there is no obstruction to the outflow of urine in the majority of cases; and that even if there were, it would not of itself give rise to inflammation, and especially not to such inflammation as would lead to suppurative nephritis.

Traube and others who do not think that the bacteria themselves excite the inflammation, consider that these organisms cause the decomposition of urea into carbonate of ammonia, and that this in turn excites the inflammation of the mucous membrane of the kidney.

For those who do not believe in the "bacteria" theory at all, there is, however, no difficulty in explaining the decomposition of urine in the renal pelvis when once chronic cystitis has begun. The muco-pus formed in the bladder soon communicates with the outer air by hanging about the urethra in its passage outwards; and further, its adhesive tenacious nature makes it cleave to the mucous membrane of the bladder, and obstruct the outflow of urine from the ureters into the bladder. The difficulty which the urine from the kidney thus finds in entering the bladder can easily be imagined by noticing the way in which the glairy, sticky, muco-pus adheres to the bottom and sides of any vessel into which the urine is passed. The more alkaline and ammoniacal the urine the more sticky and adherent is the muco-pus, because

the alkalinity acts on the pus to make it mucoid in its physical characters. The obstruction thus caused excites pyelitis, the pyelitis induces ammoniacal decomposition of the urine retained in the overstretched renal pelvis, and the suppurative process spreads thence throughout, or in circumscribed areas of, the kidney.

2. When pyelitis is provoked by the impaction of a renal calculus in the pelvis or ureter of the kidney; or when it occurs in the course of any of the continued fevers, alkaline fermentation of the urine results, in the way just stated, through the agency of the muco-pus which is secreted by the mucous membrane of the pelvis and calyces of the kidney.

We proceed now to the description of the several forms of disease of the kidney which are caused by obstruction in the urinary passages.

CHAPTER XXI.

HYDRO-NEPHROSIS.

Hydro-nephrosis is the term applied to over-distension of the kidney with urine. It is a mechanical result of obstruction to the outflow of urine from the kidney, no matter whether the cause of the obstruction be situated in the urethra, bladder, or ureter; nor whether a renal tumour appreciable during life be formed by the dilated kidney or not.

In the most extreme cases the seat of obstruction is generally the ureter or the vesical orifice of the ureter. In double hydro-nephrosis, in which the degree of distension is often less excessive, the seat of the obstruction is in or in front of the bladder.

It is long since a special name was first given to this condition. Martineau, in 1785, called it "hydrops renis"; Frederick A. Walter, in 1800, called it "hydrops renalis"; and James Johnson, in 1816, suggested "hydro-renal distension"; but since the publication of the "Traité des Maladies des Reins" in 1841, the term "hydro-nephrosis," therein employed by Rayer, has been in common use.

Hydro-nephrosis is not to be confounded with renal cysts, and therefore the term "cystic tumour of the kidney," which has also been employed, is too vague; for whilst it includes and implies many different cystic conditions, it by no means indicates "distension by backward fluid pressure."

It is more especially since the days of ovariotomy and the removal of other abdominal tumours that cases of hydro-nephrosis have been carefully studied and better understood.

Etiology.—The causes of hydro-nephrosis are (1) congenital and (2) acquired. Probably one-third of the cases in which a palpable tumour is formed have a congenital cause. Roberts, of Manchester, found a congenital malformation (affecting kidney, ureter, or renal artery) in twenty out of fifty-two cases. In four cases the ureter was congenitally imperforate; in three it entered too obliquely into the pelvis of the kidney; in two a supernumerary renal artery crossed and compressed the ureter near its origin. In thirteen out of the twenty cases the hydro-nephrosis was double; and of these two were still-born, five died within five months, and the others lived for periods varying from five and a half years to thirty-eight years.

The congenital causes do not always give rise to hydro-nephrosis in infancy or very young life. There are several cases on record which show that a congenital cause has acted very slowly and incompletely,

if at all, for a long time; but that after some, even many years, a hydro-nephrotic tumour has been formed and terminated fatally. Hydro-nephrosis due to a congenital cause is not therefore the same thing as "congenital hydro-nephrosis," a subject upon which something will be said later on.

Amongst the *congenital causes* are to be found twists of the ureter upon its own axis (Hare), undue obliquity (Roberts, Thompson, Dumreicher), reduplications, folds, contractions (Rayer), and other anomalies of the ureter. Sometimes the ureter has been found in part, or throughout, a fibrous cord (Thurnam); but in such case the hydro-nephrosis exists at birth, and goes on increasing afterwards.

In other cases the vesical orifice of the ureter is thick, rigid, and of merely pin-hole size (Reynaud and Steiner); in others, again, minute cysts are developed within its mucous membrane; in others it joins the kidney at such an acute angle (Roberts) that urine can with difficulty only flow downwards, though a probe can be readily passed along the ureter from below. In a case related by Boogard of a young man, aged twenty, who died five days only after the hydro-nephrosis was first observed, the right renal artery divided into two branches, the lower of which compressed the ureter. Roberts, of Manchester, records a case * in a young man, of twenty years, who had double hydro-nephrosis, on the left side caused by a contracted and too oblique ureter, and on the right side by the pressure of a branch of a renal artery on the ureter. Krause described the case of a woman in whom a valvular flap of membrane at the renal orifice of the ureter was the cause of obstruction. Lagrave found a hydro-nephrotic kidney dependent upon compression of the ureter by menses retained in one-half of a bifid uterus.

* "Urinary and Renal Diseases," p. 545. 4th ed.

Walter described the case of a man, aged thirty years, who had two ureters and two pelves to each kidney; the upper part of his right kidney was converted into a cyst, the right upper ureter was dilated and opened into the bladder close to the prostate, it passed down in front of the right lower ureter, which opened almost in the median line of the bladder. The right lower ureter and lower half of the right kidney were not distended.

Dr. Strange * records the case of a farm labourer, aged eighteen, in whom diabetes insipidus had existed from infancy. The kidneys at the time of death were mere sacs two or three times larger than normal kidneys, and there was a complete absence of all parenchymatous substance cortical and tubular; the sacs were divided into a number of cells by the inter-tubular septa which occur in the fœtal state. The ureters were also greatly dilated, being from three to four and a half inches in circumference. The urine contained in the sacs and ureters had no urea, no albumen, and no sugar.

Another very similar case is recorded by Faber,† in which the belly was enlarged from birth, and there were recurring paroxysms of symptoms like those of stone in the bladder; the boy died at the age of five and half years, when both kidneys were found converted into large sacculated pouches without a trace of renal substance in them; and the ureters were like the small intestine in size.

In these two cases the atrophy of the renal substance had doubtless commenced at or before birth, and had gone on progressively afterwards.

The *acquired causes* of hydro-nephrosis are numerous, and, like the congenital, may be situated in, behind, or in front of the bladder.

* Beale's "Archives," p. 276; 1862.
† "Wurtz Correspondenz-Blatt," Bd. xii. p. 236.

From the records of the post-mortem examinations of 2,610 bodies, made during the ten years ending 1883, at the Middlesex Hospital, I find 142 cases of marked hydro-nephrosis. Slight and only moderate dilatations of the kidney are not included in this number, but only those cases in which there was very advanced change in the kidney. Many of these kidneys are described by the words "enormously dilated;" as large as "an orange," or as "a cocoanut;" "pelvis distended and renal substance atrophied, so as to leave a thin-walled chambered cyst;" "pelvis dilated into a large pouch, renal substance wasted so that the solid part of the kidney formed a mass not larger than a large walnut;" "kidney small, but converted into a mere chambered cyst, the ureter greatly dilated;" "pelvis and calyces widely distended, ureter the size of the small intestine of a child." These and such-like expressions are used to describe the cases included in the list. In some instances of double hydro-nephrosis it is quite clear that one kidney was affected long before the other; and that in the meanwhile the second kidney had undergone considerable hypertrophy. Hence the apparently incompatible conditions of great distension of ureter, pelvis, and calyces of the kidney, and great bulk of renal substance were sometimes coexisting in the same organ.

An analysis of the 142 cases shows the causes to be:

1. Cancer of the pelvic organs; uterus, vagina, bladder, or rectum, in 116 cases.

2. Cancer of one or both ovaries in two cases.

Of the 116 cases (most of which were primarily uterine cancers, though in many of these the vagina, bladder, or rectum became subsequently involved):

93 were double hydro-nephrosis.
16 affected the right kidney only.
7 affected the left kidney only.

Of the two cases of ovarian cancer,

1 affected the right kidney only, the right ovary only being diseased.
1 affected both kidneys, both ovaries being diseased.

Of the 24 remaining cases the cause was

Unknown in 4.	Enlarged prostate, 3.
Cystitis in 3.	Ovarian cysts, 4.
Vesical calculus, 3.	Constriction of ureter, 3.
Villous growth of bladder, 1.	Cancer of abdominal organs pressing on ureter, 3.

Of these 24 cases due to causes other than pelvic cancer,

12 were double.
9 affected the right kidney only.
3 affected the left kidney only.

Of the 12 cases in which the hydro-nephrosis was single, the dilatation was due

To causes "unknown"	4
To constriction of one ureter	3
To S-shaped twist in ureter	1
To cancerous tumours in *abdomen*	3
To ovarian cyst	1

In those in which the hydro-nephrosis was double, the causes were

Cystitis . . .	3	Enlarged prostate	3
Vesical calculus .	3	Ovarian cysts .	3

In thirty-two cases recorded by Dr. Roberts, the cause was found to be impaction of calculus in the ureter in eleven, and in three others it was presumably due to this same cause, though the calculus was not actually discovered; in five there was a narrowing or obliteration of the ureter near its origin or termination, produced presumably by some preceding inflammation or ulceration; in six cases the ureter had been compressed by pelvic tumours; and in three by peritoneal inflammatory bands.

Thus, from Dr. Roberts's cases, it would seem that a not uncommon, and to the practical surgeon a very important cause, is a calculus impacted in the renal pelvis or the ureter; and besides the cases in which there is a calculus discovered, there are also those in which the passage of a calculus from the kidney to the bladder has caused ulceration and subsequent contraction of the ureter at some spot or other.

Contraction of the ureter may follow an injury. A case is recorded by Dr. Pye Smith of a farrier, aged twenty-four, who was kicked "under the short ribs," and passed blood with his water; two years later a hydro-nephrotic tumour on the same side of the abdomen (the left) was discovered and twice tapped; at the post-mortem the ureter was dilated for an inch and a half and then suddenly became contracted so as not to admit the smallest probe. The cyst communicated with the adherent intestine. The contraction of the ureter was supposed to have been caused by the kick.

Other cases in which hydro-nephrosis has followed an injury to the renal region are recorded by Croft * and by Hicks, and Solier of Lyons. † In other cases again, the ureter has been found degenerated into a hard, thin, impervious cord, but the cause of the obliteration had not been so clear as in the above-quoted cases.

Cooper Rose records the case of a young lady who suffered from a tumour of the abdomen for fifteen years, which was throughout supposed to be ovarian, and was tapped; nothing but a thin layer of cortical substance was left of the kidney; the ureter was quite impervious.

Other causes of obstruction to the outflow of urine are contraction of the vesical orifice of the ureter

* Clinical Transactions, vol. xiv.
† *See* Roberts, p. 544. 4th edition.

from inflammation, ulceration, and tumours or abscess of the bladder; abscess of the pelvic cellular tissue when affecting the lower part of the ureter; strumous and enlarged lymphatic glands which press upon the ureter in any part of its course; adhesions, or bands of fibrous tissue; cancer of the pelvic organs; stone in the bladder; enlarged prostate, stricture of urethra; and in the female various morbid conditions of the uterus and its appendages. Ebstein* gives an instance of double hydro-nephrosis due to an abscess at the fundus of the bladder after lateral lithotomy: the orifices of the ureter lay within the area of the abscess; each ureter was dilated to the size of the small intestine; both kidneys were excessively enlarged, the left being completely transformed into a hydro-nephrotic sac with scarcely a trace of renal substance remaining. I have myself seen a sacculus in a thin dilated bladder (associated with, if not caused by, enlarged prostate) which had produced great dilatation of one ureter from dragging upon and partly occluding the ureteral orifice.

I have recorded a case of intermittent hydro-nephrotic tumour due to a papilloma of the bladder; there were portions of the growth in connection with both ureteral orifices, but the hydro-nephrotic kidney was hypertrophied, the other was atrophied. In another case under my care, of extensive double hydro-nephrosis (not, however, amounting to an abdominal tumour), wide-spread villous disease of the bladder was the cause. Silbermann mentions a case seen by him in a child ten years old, in whom hydro-nephrosis of the right kidney was caused by a fibroma of the bladder about the size of a walnut which blocked the vesical orifice of the right ureter.† The case is of interest, because the condition

* Ziemssen's "Encyclopædia," vol. xv., p. 647.

† *Berliner Klinische Wochenschrift*, xx. p. 518; 1883.

suggested to Silbermann the instrument he has devised for temporarily closing one ureter. (*See* page 111.)

Dr. Simpson * saw a right kidney which had been converted into a cyst the size of a fœtal head, by a thickened band of fibrous tissue passing along the brim of the pelvis from the promontory of the sacrum, and compressing the right ureter.

Rayer mentions the case of a woman, æt. forty, who had a fluctuating tumour in the right side caused by compression of the ureter by enlarged and indurated lymphatic glands, between the uterus and iliacus muscle, secondary to cancer of the uterus; the left kidney and ureter were unaffected.

Pelvic tumours, cancer of the pelvic organs, versions and flexions of the uterus, enlargement of the prostate, stricture of the urethra, and phymosis, though frequent causes of hydro-nephrosis, rarely lead to such an amount of distension as to produce an abdominal tumour.

Amongst the numerous cases of cancer of the pelvic organs annually examined at the Middlesex Hospital, there had not been, up to 1876, in the memory of any of the surgeons then attached to the Hospital, a single instance of an abdominal tumour from hydro-nephrosis due to that cause; nor am I aware that any such case has occurred since. Rayer had only seen one case, that just referred to, in which an abdominal swelling was due to hydro-nephrosis from cancer of the uterus; and in that case the immediate cause of the renal distension was pressure by enlarged pelvic lymphatic glands.

Hildebrandt considers retroflexion of the uterus an occasional cause of hydro-nephrosis, and he records such a case in his writing on retroflexion; he explains it by the bending of the ureters, as they pass along by the side of the neck of the uterus, owing

* Simpson; *Glasgow Medical Journal*, vol. ii., 1867.

to the version of the womb, and this in turn causing obstruction to the outfall of urine from the kidneys. He found a large soft tumour above Poupart's ligament on the left side, which was removed by pressure on the abdominal walls when a catheter was introduced into the bladder and the uterus was straightened by a sound. The swelling in another similar case was best felt when the patient was upright, because in the recumbent position the urine was dispersed along the whole length of the ureter, and thus did not form a circumscribed swelling.

There is one cause of obstruction to the outflow of urine from the kidneys, which, though it may not be powerful enough of itself to give rise to a hydro-nephrotic tumour, doubtless aids materially any partial obstruction of one or both ureters from any other cause, such as renal calculus or morbid growth of the bladder. I allude to frequency of micturition. Frequency of micturition means frequent contraction of the muscular walls of the bladder; frequent closure of the vesical orifices of the ureters owing to the anatomical arrangement whereby the ureters traverse the parietes of the bladder; and thus frequent resistance to the outflow of the urine from the ureters. Dr. James has reported a case in the *Edinburgh Medical Journal* (p. 135, 1877), in which frequent micturition, due to phymosis, was, he believes, the proximate cause of the hydro-nephrosis, the contractions of the bladder preventing the flow of urine through the ureters. I refer with special satisfaction to Dr. Alexander James's paper on hydro-nephrosis because I did not know of its existence when writing the above. Dr. A. James * observed many times, in washing out the bladder of a paraplegic patient, that its walls would remain so firmly contracted

* *Edinburgh Medical Journal*, Nov., 1878.

round the catheter for thirty seconds or longer at a time, as not to admit a single drop of water, even with a head of three feet, to enter the viscus. This, as he remarks, is specially interesting, as helping to show that the increased frequency of micturition which occurs in irritable bladders will cause dilatation of the ureters and renal pelvis by damming back the urine in those tubes. It seems to me very probable that it is in this manner that phymosis, stricture of urethra, prostatic enlargement, vesical calculus, and other such-like causes of frequent and straining micturition, lead to hydro-nephrosis; for these conditions do not *directly obstruct the ureters* as do an impacted renal calculus, a papilloma growing over the ureteral orifice, a pelvic tumour, and the various other conditions above enumerated.

Hydro-nephrosis may affect **both kidneys, or only one, or even may be limited to only part of one kidney.** According to Dr. Roberts, out of thirty-two cases in which the cause of obstruction was not congenital, the hydro-nephrosis was double in seven; as against thirteen cases out of twenty in which the cause of the obstruction (and in several the tumour also) was congenital.

In rare cases the hydro-nephrosis has been partial as well as unilateral; *i.e.* it has involved only some of the calyces of the kidney. This has been the condition in some few instances in which there have been two ureters for a kidney, and one of the ureters only has been occluded.

Mr. John Wood * recorded a case of a girl, aged ten years, with a double pelvis and ureter to her left kidney, and a single undersized ureter issuing from the lower end of the right kidney. At the upper end of the right kidney was a cyst the size of a walnut, with tough fibrous walls, and with a thin layer of

* Path. Soc. Trans., vol. vii., p. 261.

cortical substance spread some way over its walls. The interior was lined by a smooth membrane, had no communication with the true pelvis of the kidney, and here and there was marked by saccular depressions like remains of calyces. Issuing from the cyst was a fibrous tube of the average diameter of a goose-quill, but sacculated in places. Its lumen communicated with the cavity of the cyst; its lower end opened into the bladder by a narrow orifice guarded by a valve near the urethral orifice. Towards its lower end were two or three distinct valvular folds of the lining membrane, strengthened by fibrous tissue, and disposed so as to resist upward flow. The cyst seems to have been a hydro-nephrotic distension of certain calyces communicating with the aberrant ureter.

Dr. Ewart* has recorded a case in which the lower part of each kidney was a sacculated cyst, the cause being tubercular disease of the corresponding ureter. Each kidney had two ureters. The distension of only one calyx has even given rise to an abdominal tumour, as in Fugel's case.† In a case of horse-shoe kidney‡ the left part of the organ was atrophied, and its pelvis was dilated, owing to pressure on the ureter of this part. The right part of the horse-shoe mass weighed fifteen to sixteen ounces; its pelvis also was somewhat dilated and inflamed, and its substance was suppurating. There was inflammation of the whole of the retro-peritoneal tissue surrounding the kidney. The cause was pelvic cellulitis after delivery. Two or three cases of abdominal tumour, caused by one half of a horse-shoe kidney, are on record.

The proportion of cases in which hydro-nephrosis produces a palpable abdominal

* Path. Soc. Trans., vol. xxxi., p. 188.

† Referred to by Staples in *Journ. of Amer. Med. Association*, April 19, 1884.

‡ Guy's Post-Mortem Records, 1877, No. 372.

tumour is very small, compared with the great frequency of hydro-nephrosis as it is seen in the post-mortem theatre. When an abdominal swelling exists there has been more or less complete obstruction affecting a kidney in its full functions, even it may be greatly hypertrophied. Moreover, in all probability the obstruction will have been of long standing though it may have been either intermittent or continuous in its action.

Up to the time of obstruction the kidney will have been actively secreting; it still goes on secreting, and the urine, finding difficulty in its exit, dilates the renal pelvis, and as much of the ureter as is above the obstruction. As the renal tissue becomes destroyed by the compression, the amount of urine secreted is, of course, lessened; but still the distension will increase, and the sacculated kidney will enlarge as long as there is any secreting structure left to add more urine to that already accumulated. If the kidney thus obstructed had previously undergone hypertrophy, the distension will increase with even greater force than in a kidney of usual size, and the hypertrophied organ will, from its own size, assist in making the hydro-nephrotic swelling more prominent.

When, on the other hand, the obstacle is slight at first, and only very gradually increases (as in organic stricture and cancer of the uterus), there is a continual mild resistance, rather than an actual obstruction, to the flow of urine, so that the secreting substance of the kidney wastes faster than the renal pelvis distends, and death occurs generally before a tumour is formed. In stricture, and in most cases of uterine disease, resistance is offered to both kidneys, and they each suffer, but cannot share the results of the obstruction. Thus there is little chance of detecting hydro-nephrosis from such causes during life,

unless the obstruction has been confined to one side for a time, and afterwards affects the other, but only after it has become hypertrophied.

When sudden and complete, or nearly complete, obstruction affects a small, fatty, or granular kidney, atrophy, and not hydro-nephrotic distension of that organ, is most likely to result.

Professor Kehrer considers that hydro-nephrosis is only met with where there has been a long-continued but not complete obstruction to the outflow of urine. The experiments of Strauss and Germont upon the ureter point to the opposite conclusion. Indeed, the mechanical effects of complete obstruction are not quite as yet clearly understood; this may be seen from a *résumé* of the subject given by Mr. Bennett May in the *Brit. Med. Journ.*, Jan. 20, 1883.

Mr. May adds the following interesting observation: "I made some experiments on the dead body with the object of ascertaining definitely the actual capacity of the ureter and pelvis of kidney under pressure. I cut the ureter close to the bladder, and introducing the nozzle of a fine syringe, injected warm water towards the kidney. When about half an ounce had entered resistance became considerable, but by continuing the pressure moderately it lessened, and then water continued to pass freely; not, however, to distend the structures, for it speedily found its way into the renal vein, and thence into the vena cava. This is evidently a reversal of what pertains during life."

It is seldom that the clinical history and course of a case of hydro-nephrosis afford accurate data for forming an opinion as to the **rate of "growth"** or development of the abdominal tumour of this nature. A case communicated by M. Danyan and quoted in the chapter (xii.) on injuries of the kidney, is of much value as proving that the pyramidal and cortical

substance of the kidney may be quite destroyed, and a large tumour formed, by intrarenal pressure in a less period than two calendar months. (*See* pages 139, 140.) As there was no reason to suppose that the injured kidney had been at all dilated prior to the accident, we have in this instance almost certain knowledge of the *maximum* time within which these extreme results of intrarenal pressure were produced. The condition was not quite the same as that of hydro-nephrosis, but the mechanism whereby the dilatation was caused was approximately the same.

Fig. 18.—Hydro-nephrosis with great dilatation of Pelvis and very little Renal Substance remaining. (Middlesex Hospital Museum.)

Pathology.—The pelvis of the kidney first becomes converted into a spheroidal sac, then the calyces are widened and stretched in every direction, and at length the capsule of the kidney is expanded, and what remains of the cortical and medullary substance of the organ becomes still further compressed and absorbed, until at length nothing remains but a more or less completely loculated bladder or cyst (Figs. 18 and 19). Thus the tension exerted by the urine, which accumulates behind the obstruction, stretches the calyces and flattens and wastes the pyramids to such an extent that the calyces are converted into huge spaces or pouches jutting off from

the dilated pelvis and separated from one another by slender septa formed by the wasted "columns of Bertini." On laying open the cavity of such a hydro-nephrotic cyst, nothing but a complete fibrous skeleton of the kidney will be seen. Sometimes nothing but a pellucid sac with at most one or two, if any, septa are

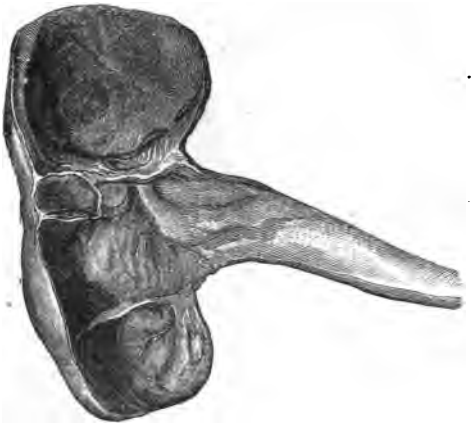

Fig. 19.—A Section of a Kidney, converted by dilatation of the Pelvis and Calyces into a Cyst, retaining the size and form of the Normal Organ, partially divided by incomplete Septa. No renal tissue remains. (Middlesex Hospital Museum.)

present (Fig. 19); at others, again, and this is more generally the case, traces of the renal tissue remain as in Fig. 18, where the pelvis of the kidney is seen greatly enlarged, and areas of secreting substance have been exposed in the section.

As a rule, the pouches formed by the dilated calyces communicate indirectly with one another through their openings into the pelvis; but in rare cases one or other or all of them may be shut off from the pelvis, and therefore from one another, either by

the presence of a large branched calculus or by fibrous septa.

There are great varieties in the proportions in which the pelvis and the body of the kidney enter into the formation of the cyst; in one case it is formed in greater

Fig. 20.—Dilatation of the Pelvis of the Kidney.

The pelvis forms a sac about the size of a turkey's egg, projecting from the hilum of the kidney. The cause of the dilatation is not stated. The ureter is healthy; the calyces are not dilated, and the cortex is not materially thinned. The surface of the kidney is granular. From the body of a woman, aged 38, who had the symptoms of chronic renal disease, following a subacute attack. (From St. George's Hospital Museum, No. 3019; 53A.)

proportion by the pelvis, which is converted into a rounded tumour as in Fig. 20; in another the absorption of the renal substance, far from being complete, may not amount to more than an effacement of the papillæ and a flattening of the pyramids. Again, in another case the whole of the pyramids may have disappeared, but the cortical portion remains scarcely, if at all, encroached on; in a third stage the cortical as well as the pyramidal substance has vanished, and nothing but mere reddish areas on the fibrous parietes, if anything, remains of the secreting tissue.

The *walls* vary in thickness very much; in one case they are composed of a thin translucent delicate

membrane; in another, of condensed white connective tissue tough and strong, and sometimes even of the consistence of cartilage; in a third, fibro-cartilaginous nodules may be found embedded in them In all cases the sac wall consists of the tunica propria of the kidney, into which the fibrous tissue of the ureter and renal pelvis is continued. Blood-vessels are not often very easily distinguished in the walls, but the renal vessels do not atrophy *pari passu* with the glandular substance of the kidney.

The *size* of the hydro-nephrotic sac may not exceed the size of a normal kidney; it may be even smaller; or, on the other hand, it may be sufficiently large to form a tense irregularly rounded swelling in the renal region, and may even occupy a great part of the abdominal cavity.

In some instances the tumour extends as high as the costal margins, as low as the iliac crest, as far inwards as the median line or beyond it, and sufficiently far backwards to cause bulging of the loin. In exceptional cases, the tumour attains such a size as to distend the whole abdomen, bulge out the lower ribs, and assume the appearance and physical characters of an immense ovarian cyst.

Sometimes adhesions form between the tumour and the parts around; thus the peritoneum may be firmly united with the greater part of the wall of the cyst; or the omentum, mesentery, pancreas, large intestine, liver, or spleen, may be firmly united to it.

The *fluid of a hydro-nephrotic cyst* is rarely like urine pure and simple. Often it is odourless, gives no reaction with heat or nitric acid or with cupric tests, has a low specific gravity; leaves scarcely any residue on evaporation, and affords no evidence of urea or uric acid; in fact, it is only water holding a larger quantity of chloride of sodium in solution, and containing a few epithelium cells. This has been the

character of the fluid in several cases of congenital hydro-nephrosis, and in some acquired cases in which atrophy has advanced until the glandular substance has become entirely obliterated. Experiments have shown that even a healthy kidney, if there be obstruction to the outflow of the urine, secretes a fluid which is deficient in urea, and, therefore, of very low specific gravity. Dr. Dickinson remarks, that if the dilatation, as it often is in double hydro-nephrosis, is common to all the urinary cavities, "their contents will be urine little changed, save that the specific gravity may be low, *as with urine secreted against pressure*, and it may have become ammoniacal." * Uric acid, urates, and oxalate of lime, may be found in the fluid; at other times the contents of the cyst are turbid and mixed with muco-pus, or with blood clot of old or recent date which gives a brown or red colour to the fluid. At others, again, urea and chlorides may be found in it in similar quantities as in natural urine; and this, too, according to Prout, even in congenital hydro-nephrosis. Epithelial and granular cells, phosphates, and albumen, are frequent constituents.

Sometimes the contents are colloidal in character, as in Dumreicher's case; and in a case described by Dickinson the same "nasty stuff" had occasionally been passed *per urethram*. In a case of hydro-nephrosis recorded by Dr. Coghill,† cholesterine was found in the fluid.

The quantity of fluid contained in a hydro-nephrotic cyst is often enormous; nine gallons, twenty-five gallons, and even thirty gallons (Glass) have been removed; and in several cases sero-mucous, albuminous, or even well-nigh normal urine had drained away through a fistulous opening in the loin in quantities varying from four to ten ounces per diem.

* *See* also case by Mr. Barker, in the *Lancet*, January 17, 1885.
† *Edin. Med. Jour.*, p. 747; February, 1875.

Symptoms.—Hydro-nephrotic distension affects each kidney about equally. It occurs at any period, from birth to extreme old age, and is met with also in the fœtus. It is nearly twice as frequent in females as in males. When the dilatation is insufficient to give rise to a tumour, there are generally no symptoms characteristic of hydro-nephrosis; it is simply a silent complication, or consequence, of some other condition to which, and not to the insidious changes going on in the kidney, the attention of the surgeon or physician is called.

It must, however, be borne in mind that the whole round of morbid changes described above may be inflicted upon the kidneys without there being any sign of an abdominal swelling. Out of forty-two cases of non-congenital hydro-nephrosis in which the renal changes were well pronounced, there was a palpable tumour in twenty-five; and in nineteen of these the tumour was unilateral, whereas in six it was double (Roberts). Out of the 142 Middlesex Hospital cases an abdominal tumour was clinically observed in but very few.

In some advanced cases in which there is no tumour, symptoms are excited simply by the obstruction: these are thirst, pain in the back, frequent micturition, total or partial or intermittent anuria, and obscure or pronounced pains in the abdomen.

When the disease is bilateral, as in cancer of the uterus, uræmia may be looked for; and though in many of these cases nothing can be made out from the urine, yet evidences of renal degeneration are seen in the dry and sallow skin, the aching loins, the nausea and sickness. When the pressure effects of cancer of the pelvic organs are associated with ulceration of the bladder, pyelo-nephritis and pyo-nephrosis, and the symptoms to which they give rise, are found; when simple obstruction by pressure is caused, and

there is no ulceration of the bladder, hydro-nephrosis alone exists, and the symptoms referable to the kidney are less marked.

Constipation from pressure on the colon, vomiting, convulsions, febrile symptoms, and coma are occasional symptoms.

When a tumour is formed, hydro-nephrosis has to be dealt with as a distinct disease, and on its own account; and more especially so when it threatens to damage neighbouring organs by its pressure, or to destroy life by bursting into the peritoneum, or in some other dangerous direction.

The tumour is dull on percussion, and is sometimes irregular or lobulated in outline, and frequently fluctuates. By its size it may cause much pain, displacement of viscera, disturbance of the action of the diaphragm, and thus of the lungs and heart; and it is especially prone to interfere considerably with the action of the colon, thus inducing constipation.

If it arises from some innocent and painless cause, such as pregnancy or flexion of the uterus, its development is unattended by any constitutional or local disturbance; but if from some painful cause, such as impacted calculus, the symptoms incidental to the particular cause will occur before the tumour makes its appearance, and will probably mask the development of the swelling.

The tumour has all the characters of a renal tumour, being situated in the flank, pressing backwards and outwards the parietes in the ilio-costal area, having the colon in front of it, and the small intestine either in front or thrust over to the opposite side of the abdomen, according to the bulk of the swelling.

Dr. Dickinson estimates that in about one-fourth of the cases of single hydro-nephrosis in which a swelling is observed during life, the tumour extended beyond the median line of the body, and that in

one-third of these it has at length occupied the greater part of the belly.

In Mr. Glass's case, by far the largest yet recorded, the belly of the patient (a tall, well-proportioned woman of twenty-two) measured six feet four inches in circumference, and the cyst held thirty gallons of fluid; the heart was pushed up to the clavicle, and the lungs by compression were reduced to the size of those of a new-born child.

There are instances of the tumour *intermitting*, that is, being prominent at one time and not distinguishable at another. I have collected and put on record nine cases where this occurred; and I have since had under my care two other cases, both in females. In many others the tumour diminishes from time to time without actually vanishing. Dr. Roberts says that this happened in nine out of the twenty-five cases collected by him, in which the existence of a tumour was clinically ascertained. In all such cases the subsidence of the swelling is no doubt followed by the discharge *per urethram* of an increased quantity of urine, and when this can be proved to occur, we obtain a most important diagnostic sign of hydro-nephrosis. In such cases, too, the urine during the increased flow will sometimes yield an admixture of blood and pus, or mucus, but will always be of a lower specific gravity than normal urine. At other times, and in cases which do not subside or intermit, the urine gives no information whatever.

It is often stated that a hydro-nephrotic tumour is quite painless, and so it may be when not of any great size. But on the other hand, when the tumour is large, the pain may be of the most agonising character, as agonising as the pain of unrelieved retention of urine in the bladder, or even more so.

In the following case the sufferings amounted to the most severe torture.

A tall, slight man, aged twenty-six years, a great athlete, was taken ill on Nov. 9th, 1883, after a long walk on the preceding day, with acute pain in the left lumbar region, coldness of the surface of the body, and in fact general collapse, with vomiting. After these symptoms, which resembled those of very severe renal colic, had lasted some hours, he rallied. For the next day or two there was diminished, but still considerable, pain in the left renal region; and a tumour was detected there. This tumour was dull on percussion, and very tense. The urine was scanty and high coloured. The temperature was slightly elevated. For a fortnight the pain continued, and was more severe at some times than at others. He lost much flesh. The tumour remained about the same. During the next fortnight the urine contained blood and pus; the tumour markedly diminished, and the patient improved in every way. More severe symptoms soon set in again; the tumour attained a large size; great pain was constantly suffered, until on December 19th it was more violent than had ever before been experienced. For three days no rest whatever could be obtained except by means of large and repeated doses of morphia. The tumour daily grew larger and more tense; and on the 22nd of December the symptoms were so urgent that an operation was imperative.

When I saw this patient I found him, clad only in his night-shirt, lying on the floor of his room, writhing and perspiring, and crying out with the agonising pain in his belly. I ascertained that in September, 1882, he had suffered a slighter, shorter, but very similar attack to that in November, 1883. It commenced suddenly with violent pain in the left loin, followed in a few days by the formation of a tumour in that situation. The pain continued for eight or nine days, when a castor-oil purge was

taken; and whilst at stool the patient felt as if something had given way in his side, and shortly afterwards large quantities of blood appeared in the urine and a greatly increased quantity of urine was voided. The tumour then markedly diminished, but for some days the urine contained blood. About this time he was seen by Dr. Broadbent, and renal calculus was diagnosed. Between the attack in 1882 and that in 1883 he resumed his former active pursuits of rowing, cricket, and football.

It was further ascertained that when ten years old he had a seizure of "severe side-ache"; but from that time till his fifteenth or sixteenth year there was no illness of any sort. During the following three years he had two attacks; and again, after an interval of two years, another and severer attack. All these seizures had presented the same symptoms; namely, agonising pain in the left side, lasting about three days, and relieved by hot fomentations. No tumour had been noticed in these earlier attacks, which had always been put down to intestinal colic. In the attack of 1882 attention was drawn to the urine for the first time.

So violent was the pain at the time of my visit, so incessant the writhings, so large the tumour, and so imminent seemed to be its rupture that I resolved on at once cutting down upon the kidney through the loin. This I did with such instruments as a pocket case contained; and after exposing, incising, and draining the hydro-nephrotic cyst, I stitched the edges of the cyst to the edges of the skin wound, and put a drainage tube into the cavity of the cyst.

The patient made an admirable recovery, and is in perfect health now, August, 1885, nearly two years since the operation; but he has an urinary fistula in the loin through which eight or ten ounces of urine daily drain away through a piece of indiarubber tubing. The urine is collected in a convenient apparatus,

which is worn round the waist. The fistula is but a very slight inconvenience to him, and does not prevent his pursuing his former active exercises.

Diagnosis.—Hydro-nephrotic distension has to be diagnosed, when of moderate size, from renal abscess, perinephric abscess, and perinephric extravasation. When it forms a palpable tumour, it may be mistaken for pyo-nephrosis, or for a hydatid or serous cyst of the kidney, liver, or spleen; and when of very great size so as in large part to fill the abdomen, it is most likely to be mistaken for an ovarian cyst or for ascites.

There is one sign which is almost conclusive of hydro-nephrosis, and that is the subsidence of the tumour, followed by an increase in the outflow of urine; but this does not very often occur. We have, therefore, to rely on other symptoms. Renal abscess and perinephric abscess are quicker in their course, and excite much more pain and constitutional disturbance in their onset and early part of their progress, certainly before any lumbar or abdominal swelling exists.

Perinephric abscess causes fulness in the loin, and tends to spread upwards and downwards, but does not present a circumscribed more or less movable tumour coming forwards in the abdomen, and felt, as the patient lies on his back, to be passing beyond the umbilicus. There is often œdema and redness of the skin of the loin in perinephric abscess, but not so in hydro-nephrosis, at any rate not until after the tumour has reached too large a size to be mistaken for perinephric abscess. In perinephric abscess the matter may burst at or below Poupart's ligament, but is not likely to point higher up in front; in hydro-nephrosis redness and superficial fluctuation are sometimes felt at a spot on the side, or towards the front of the belly.

After an injury to the loin or renal region, it may

be a question whether a tumour, which forms in this situation, is a collection of urine within the kidney and pelvis of kidney due to occlusion of the ureter by blood clot or partial laceration of its coats; or is a circumscribed collection of urine and blood in the perinephric tissue due to a more or less complete rupture of the kidney or its pelvis. In the latter case the swelling will attain a considerable size in a short time, because the kidney being displaced and not compressed from within, will offer less obstruction to the secretion and outpouring of urine than when the dilatation is of the kidney itself. The swelling, though circumscribed, is likely to be much less defined and limited in front, and more diffused behind, above, and below, than a hydro-nephrotic swelling.

Between hydro-nephrotic and pyo-nephrotic tumours the diagnosis is often quite impossible. If the urine is or has been distinctly purulent, and if rigors, feverishness, and other indications of suppuration have preceded and accompany the swelling, then pyo-nephrosis may be diagnosed. But in many cases of pyo-nephrosis these symptoms are wanting; moreover, a hydro-nephrotic sac may suppurate quietly, and thus pass by degrees into a pyo-nephrotic tumour.

Hydatid and serous cysts of the kidney will best be diagnosed by their history. Is there or has there been any cause of obstruction? If so, the swelling is in all probability hydro-nephrotic. Hydatid of the kidney is often secondary to, or associated with, hydatid of liver. If a hydatid vesicle has escaped with the urine, the diagnosis is clear; but this aid is not always forthcoming.

In hydatid of liver or spleen the tumour bulges less into the loin, and more towards the front of the abdomen, or upwards against the diaphragm, than a renal tumour; it is continuous with the liver or

spleen; moves more decidedly and freely in a vertical direction during respiration, and is moved less freely by palpation from side to side. Even if, as may be the case, there is resonance over a great part of the front surface of a hydatid cyst of the liver, the extent of the anterior limits of the tumour, together with the absence of fulness in the loin, and the other symptoms mentioned above, will generally suffice to exclude hydro-nephrosis.

Where the tumour is of great size, hydro-nephrosis is most likely to be mistaken for ovarian tumour. This error has been many times committed. There are at least fifteen cases on record in which hydro-nephrotic or simple renal cysts have been mistaken for ovarian tumour, and laparotomy performed on the erroneous diagnosis. Out of twelve cases of hydro-nephrotic cysts in women which I collected in 1876, no less than seven had been diagnosed as ovarian, and no less than five of the seven were submitted to abdominal section on the strength of this wrong opinion. I think it highly probable that a great many of the tumours which have been diagnosed ovarian, but which, nevertheless, have spontaneously vanished, were hydro-nephrotic in their nature, and disappeared by the discharge of the urine through the natural channel.

With care, however, an ovarian tumour will be excluded if attention be paid to the direction of the growth of the enlargement, to its relation to the colon, and to the evidence afforded by a vaginal and rectal examination. I have seen an ovarian cyst even after removal very closely simulate a hydro-nephrosis. The diagnosis had been very difficult, and when the cyst had been excised, the Fallopian tube was found adherent to the wall, and communicating with the cavity of the cyst. It resembled a hydro-nephrotic cyst opening into the dilated ureter.

When the tumour is renal the uterus is neither displaced nor fixed, but there are generally some symptoms referable to the urinary organs. A renal cyst is rarely so mobile as many ovarian tumours are. The large intestine can generally be detected in front of a hydro-nephrotic cyst; sometimes it may be even rolled between the cyst and the fingers on the front of the abdomen; or gurgling and the sensation of flatus may be detected. A caution is needed respecting the relation of the colon; occasionally, and especially when the tumour has attained a great size, the colon gets behind the bulk of the tumour, whereas a portion of the intestine has in rare cases been found in front of an ovarian tumour.

If with the fingers in the vagina or rectum a calculus or other cause of ureteral obstruction can be made out in the lower end of the ureter, the diagnosis would be assisted and the cause of the hydronephrosis explained. Much information may be gained about the state of the uterus and ovaries, and the relation of the tumour to those organs, by vaginal or rectal examination, and especially if the examination is assisted by the other hand upon the front of the abdomen at the same time.

When the dilatation is very considerable, and the attenuation of the cyst very extreme, fluctuation may be so general and so superficial that ascites may be thought to exist, as in Dr. Hillier's case.* The character of the fluid withdrawn, and which will probably have an urinous odour, and contain urea and uric acid and more or less albumen, will correct such an error. Ascites may, however, co-exist with hydronephrosis, as with any other solid or fluid growth within the abdominal cavity.

The **prognosis** depends much upon the cause of the distension, but chiefly upon whether one or both

* Med.-Chir. Trans., vols. xlviii. and lii.

organs are involved. If only one kidney is affected the other can do duty for both, and life may be indefinitely prolonged, provided the size of the tumour is not great; or, if the tumour be large, provided relief from distension is afforded in good time. If the distension increases, death will result from the effects of pressure on neighbouring organs, from rupture into the peritoneum, or from suppression of urine or uræmia. Traumatic rupture of the cyst has been the termination of more than one patient. Simon mentions four cases of this kind. Spontaneous rupture into the peritoneum is not a frequent occurrence. Roberts found it only once in nineteen fatal cases. Taylor * records a case in a girl, aged fifteen, of acute hydro-nephrosis, which ruptured into the peritoneal cavity, but which was successfully treated by laparotomy in the median line, cleansing of the peritoneum, and stitching the cyst walls to the abdominal opening. All the urine from the kidney (left) came by way of the fistula; but Mr. Taylor wisely deemed it best to advise the girl to put up with the inconvenience of the fistula. The question, however, might fairly be raised as to whether the better practice would not have been nephrectomy at the time. In most cases where the distension affects both kidneys, the cause of the hydro-nephrosis kills the patient, though, even then, one of the chief factors in producing the fatal result is the destruction of the glandular substance of the kidney, and the gradual cessation of the renal function.

In some cases the tumour has spontaneously subsided and never returned; this was the termination in six cases out of a total of forty-seven which I have collected; in a seventh case where the tumour intermitted many times, it at length subsided, and had not reappeared when the patient was heard of a long time

* *Lancet*, Oct., 1884.

afterwards. If the tumour is small and does not increase, the possessor will probably die of some independent disease; but there is always the fear lest a calculus or some affection of the opposite kidney may cause death by suppression of urine or by uræmia. When the ureters and calyces of both kidneys are dilated by stricture, enlarged prostate, vesical growths, etc., operations upon the lower urinary organs are full of risk to the patient, owing to the great liability of inflammation spreading up along the ureters, and ending in diffuse suppurative pyelo-nephritis.

Treatment.—The treatment of hydro-nephrotic tumours is purely surgical; nothing can be done for them by medicinal remedies. When of small size, painless, and not on the increase, they may be left alone. When they cause trouble either by their weight, pressure, or size, the aspirating needle should be employed when there is any reasonable ground for believing that the cause of obstruction is temporary, and that reaccumulation is not likely to recur.

An attempt might be made to overcome the obstacle to the passage of urine by friction. Two cases at least are on record in which the tumour subsided after manipulation. One was under Dr. Roberts in the Manchester Infirmary, the other was reported by Dr. Broadbent. In Dr. Roberts' case the tumour was rubbed in every direction with a lubricating ointment every other morning, and after the third application the patient, a girl, aged eight, suddenly passed a large quantity of urine, and the swelling forthwith subsided and did not return. In Dr. Broadbent's case a child three months old, whose abdomen had been large from birth, though urine had been passed in usual quantity, had an enormous tumour which disappeared after friction with iodine ointment. The child, however, subsequently died. Probably this treatment,

which answered so well in these two cases, was suggested by a third case reported by Mr. Thurnam in 1837. A little boy four months old had a lobulated tumour from alternate dilatations and contractions of the whole length of the ureter; the mother of the patient was in the habit of rubbing it with her hand to relieve pain, and when she did so she noticed the child's bladder swelled up as large as an egg.

In many cases, however, manipulation could not be tried; either because the tumour is far too painful to allow of it, or because the degree of distension would make the risk of rupturing the cyst wall too great. In these cases, as well as after the failure of rubbing, paracentesis is the next means of relief, and then the place for puncturing must be considered.

In the absence of any very distinctly fluctuating area where the skin is discoloured or the sac thin, no better spot can be selected, if the tumour be of the left kidney, than one just anterior to the last intercostal space; but if the tumour be of the right kidney this is too high, as the liver in all probability would be traversed. I have on several occasions tested the truth of this statement in the post-mortem room, and in only one experiment did the liver escape; in this single instance it was very small and markedly distorted from cirrhosis. In one case, that of a young person with healthy viscera, whose death had been caused by a fall, the liver was considerably displaced upwards by effused blood; but in spite of its upward displacement it was transfixed by the needle three-quarters of an inch above its right free edge.

In no instance was the spleen punctured by inserting the needle in front of the eleventh intercostal space on the left side.

If there be no indication for operating elsewhere, the best spot to select, when the tumour is of the right kidney, is one half way between the last rib

PLATE III.

Fig. 1.—Cysts on mucous membrane of ureter and renal pelvis. Kidney granular and cystic.

Figs. 2 and 3.—Calculi tightly filling kidney and plugging its pelvis. Pus had dried up into a concretion between the calculi.

Plate III

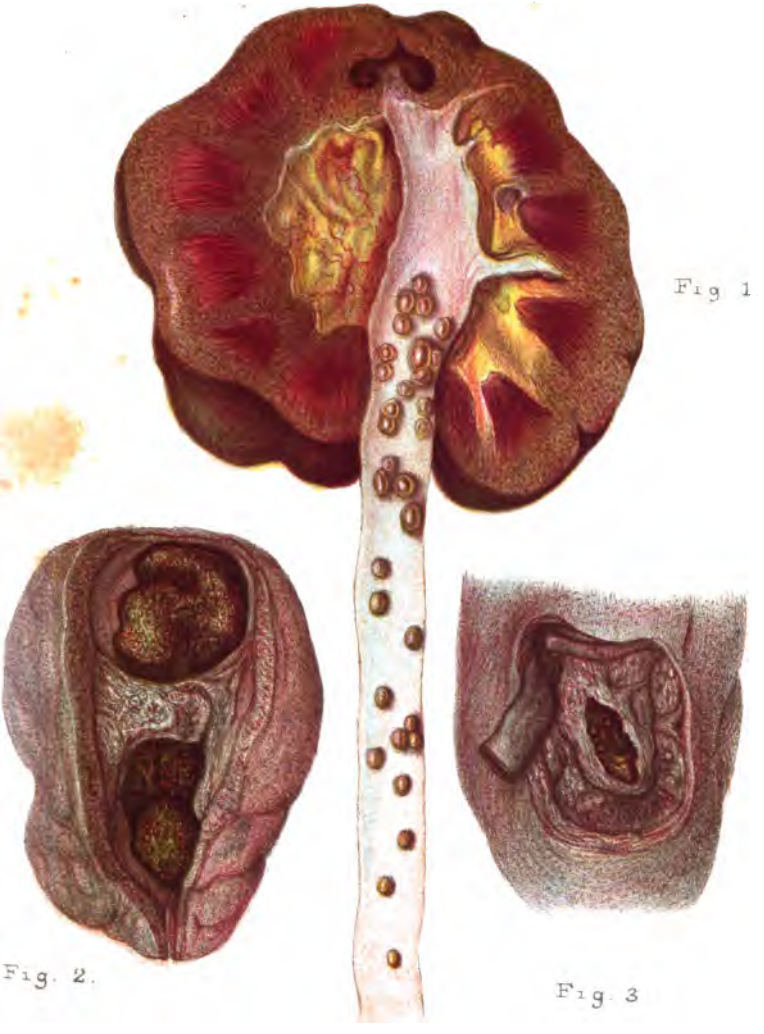

Fig 1

Fig. 2.

Fig 3

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because in more than one of the fatal cases further treatment ought to have been adopted, and thus they might have been removed from the list of deaths into a list of "unrelieved by puncture, but cured by incision."

And it must be expected sometimes, perhaps often, that after the puncture either the cyst will repeatedly refill, or suppuration will occur; in either event nephrotomy and drainage ought to be employed. In one case each, uræmia, erysipelas, perinephritis resulting in inguinal abscess, and œdema of the lungs, have caused death. When the puncture has been made far forwards, death has been hastened by peritonitis due to the escape of fluid from the cyst into the peritoneum. In one or two instances in which the puncture treatment has been employed, death occurred, long subsequent to the last puncture, from spontaneous rupture of the cyst, a termination which would certainly have been prevented by lumbar nephrotomy. Puncture, followed by the injection of iodine, tincture of iron, or other fluid intended to excite adhesion or contraction of the cyst walls, is dangerous, and hitherto has been utterly futile. I know of no case in which the practice has been successful, though it has been several times tried.

Puncture with a large trocar and canula, followed by the retention of the canula, is the oldest method of drainage; but it is imperfect, and not comparable with nephrotomy followed by the stitching of the cyst wall to the parietes of the loin.

Cauterisation of the abdominal walls with the view of exciting adhesions between the parietes and the cyst prior to nephrotomy or to draining with a canula, is unnecessary, tedious, and fraught with danger. Peritonitis and septicæmia have followed, and caused death.

Nephrotomy is the proper operation for cases in

which aspiration has failed, and which need further treatment. It is performed as described in the chapter on the operations on the kidney. As soon as the cyst is exposed through the wound in the loin it should be tapped and the fluid withdrawn; then the puncture hole should be enlarged with a bistoury, and the edges of the cyst stitched to the edges of the wound in the abdominal parietes. If the lumbar incision is made high and carried far enough forward plenty of room is obtained, so that the cyst wall can be readily drawn up into the loin wound.

Drainage and antiseptic irrigation are effected by means of a large rubber tube, which should be fixed in the cyst, and Condy's fluid, thymol, or weak carbolic acid in solution should be passed through it daily.

This practice has been very successful, and ought certainly to be adopted when aspiration fails and before nephrectomy is dreamt of. Of seventeen cases collected by Staples all recovered, though in more than half of them it is stated that a fistula in the loin was formed. In a few cases a complete cure will be effected and the wound will quite close. In more cases, however, a fistula must be expected; but the fistula gives little inconvenience to a person of ordinary intelligence and patience. Simon had a case in a man who recovered with a renal fistula discharging 150 cubic metres of fluid daily, and who worked as an efficient nurse in the surgical clinic at Heidelberg. In the gentleman whose case I have related above, ten ounces of urine pass daily; but he manages his fistula and the receptacle which he wears over it himself, and passes his life in an active, indeed, a very athletic manner. In another case, a woman, the fistula gave so little inconvenience that she expressed herself as very contented with her condition, and quite repulsed the idea of undergoing an operation for the removal

of the kidney. Lumbar nephrotomy needs no preliminary application of caustics; indeed, the peritoneum will not be even approached in most cases.

Schramm has mentioned the results of treatment in four cases of hydro-nephrosis in wandering kidneys; in one a cure was effected by removing the diseased organ; in the other three recovery with the establishment of a permanent renal fistula followed drainage. In Taylor's * case, in which, after rupture of a hydro-nephrotic cyst into the peritoneum, the abdomen was opened, the peritoneum cleared of the urine, and the cyst wall stitched to the opening in the parietes, the patient made a good recovery with a permanent fistula, which, however, did not drain nearly so perfectly as it would have done through a lumbar opening.

Nephrectomy can rarely be required for hydro-nephrotic cyst. Still, when a fistula remains in the loin after nephrotomy, and the character of the fluid is very purulent or offensive, showing that what remains of the renal tissue is incapable of performing the proper function of the kidney, the patient runs risks from the continuance of such a sinus, and cannot derive any benefit from retaining such a useless remnant of the kidney. Lumbar nephrectomy should in such a case be performed.

Up to the present there have been at least twenty-seven nephrectomies for hydro-nephrosis, of which sixteen were abdominal and ten lumbar, and in one the character of the operation is unstated; moreover, there have been five unsuccessful and uncompleted operations. Of the sixteen abdominal cases, seven recovered; and of the ten lumbar operations seven recovered; the doubtful case was fatal. Four of the fatal cases were diagnosed ovarian, and three of the successful abdominal cases were also diagnosed ovarian

* *Lancet*, Oct., 1884; p. 589.

or broad ligament cysts. The cases of mistaken diagnosis have not, therefore, all gone to swell the list of fatal abdominal nephrectomies as some writers would lead us to suppose.

After nephrotomy for hydro-nephrosis a sound should be introduced through the lumbar incision with the object of detecting a stone, if one is present, in the upper end of the ureter or the renal pelvis.

REFERENCES.

Rayer: "Maladies des Reins," vol. iii.
Roberts: "Urinary and Renal Diseases."
Dickinson: "Renal and Urinary Affections," vol. iii., chap. ix.
Barker: Med.-Chir. Trans., vol. lxiii. and lxiv.
Staples: *Journ. of Amer. Med. Association*, April, 1884.
Paper by Dr. Alexander James; *Edin. Med. Journ.*, 1877 and 1878.
Paper by author in Roy. Med.-Chir. Trans., vol. lix. (1876), in which will be found references to forty-seven cases of *hydro-nephrotic tumour*.

CHAPTER XXII.

CONGENITAL HYDRO-NEPHROSIS.

By congenital hydro-nephrosis is meant hydro-nephrosis in the fœtus and new-born; not hydro-nephrosis which occurs some time after birth and is due to a congenital cause.

In by far the larger number of cases of congenital hydro-nephrosis both kidneys are involved; but this is not always the case. When one kidney only is affected the obstruction will have been caused by some abnormality of the corresponding renal artery; or some obliquity, contraction, or actual occlusion of the ureter. In the famous case cited by Bonetus in the "Sepulchretum" * an evident tumour

* Tome ii., p. 290.

of the right kidney was produced by complete occlusion of the ureter. Billard* has recorded the case of a male child who had a large rounded hydro-nephrotic tumour in the left lumbar region due to malformation of the ureter. Towards the bladder the ureter terminated as usual, but above it formed two small thin impervious cords, which joined the pelvis by a number of filaments resembling a goose's foot. The right kidney was somewhat larger than normal, and contained turbid urine and a large quantity of sand-like calculous matter. The infant lived one month. Cruveilhier mentions a case due to congenital absence of the ureter.

When both kidneys have been involved the most common cause has been imperforate urethra; it may be a mere membranous septum at some point, or a more or less complete absence of the urethra without any communication with the bladder. Lamotte recorded a case in which a thin membrane situated at the vesical orifice of the urethra and producing hydro-nephrosis, was readily broken down on passing a sound. Billard† has described the case of a still-born male in whom there was only about an inch of urethra extending from the end of the penis to the front of the perineum; an internal orifice of the urethra did not exist. The rectum ended in a cul-de-sac adhering to the bladder; there was no anus, and only a very doubtful representative of a prostate gland. Howship‡ gives the description of three cases in which the cause was imperforate urethra. Dr. Kennedy§ exhibited to the Dublin Pathological Society the body of a new-born infant with enormous distension of the urinary organs due to obstruction of the urethra.

* "Traité des Maladies des Nouveau-nés," p. 434
† *Op. cit.*
‡ "Treatise on Diseases of the Urinary Organs."
§ *Dublin Journ. Med. Sciences*, 1840.

In the instance of a still-born child (male) brought under my notice by Dr. George Roper, and which I dissected, the kidneys, ureters, and bladder were all greatly distended, and the only ascertainable cause was a small cyst in the mucous lining of the membranous urethra. This cyst did not quite fill the lumen of the urethra, but being situated on the floor of the passage, it formed an effective barrier to the outflow of urine. It was most probably one of the follicles of the mucous membrane much enlarged. Minute cysts, very similar in character, are found occasionally in the ureter and pelvis of the kidney. Plate III., Fig. 1, shows such a case; the specimen was placed in the Middlesex Hospital Museum by Dr. Coupland.

In another case, the details of which I published in 1876,* the cause of the obstruction could not be ascertained, but there was no reasonable ground for doubting that it was either such a cyst as in the case just mentioned, or else a thin, easily broken down membranous septum in the urethra.

Cases in which no stricture or other cause of obstruction has been found are recorded by Braxton Hicks,† Gervis,‡ Smellie, Honerkopff, and Dr. A. R. Simpson.§

In each of these cases the seat of the obstruction, whatever its cause, must have been at the vesical orifice of the urethra or altogether in front of the bladder. It was most likely some slight obstacle which was overcome on the introduction of a bougie, without being noticed; or by the pressure to which the fœtus was subjected during parturition.

It is quite possible that tonic spasm of the urethra or sphincter of the bladder may be the cause of

* *Lancet*, vol. i. The case was read before the Royal Med.-Chir. Society.

† Trans. Obstetrical Soc., vol. v.

‡ Ibid., vol. vi.

§ *Glasgow Med. Journ.* (New Series), vol. ii., p. 336.

double congenital hydro-nephrosis in some cases. In support of this view there is the undoubted fact that spasmodic muscular action occurs in the fœtus *in utero* to such a degree as to cause many congenital deformities such as club foot, congenital dislocation, wry neck, etc.

It is certain that in some cases of congenital double hydro-nephrosis the cause has resided in both the ureters. Braxton Hicks recorded a case of enormous distension of the abdomen of a fœtus, which impeded labour and necessitated the use of the crotchet. The abdominal distension was due to double hydro-nephrosis from obstruction of each ureter. Dr. Broadbent* has published a case, in which the obstruction affected both kidneys of a female infant, and was due to valves of mucous membrane near the pelvis of each kidney. Dr. Lee reported a case in a female in which the cause was impervious ureters.

The period over which congenital hydro-nephrosis extends varies. In many cases the fœtuses are born dead, sometimes before the completion of the full period of gestation. In other instances the children are born alive, but die within a short period after birth, viz. from a few hours to three or four months. In Dr. Broadbent's case the tumour subsided after friction, but the infant died when between three and four months old. Faber's case, a male, died from a fall when five and a half years old; he had been ventricose from birth. Lamotte's case seems to have survived; for though no urine had been passed since birth and a large abdominal tumour existed, urine escaped, and the swelling entirely vanished after a membranous obstruction in the urethra had been broken down.

The character of the fluid in congenital hydro-nephrotic cysts. — The urine removed

* Path. Soc. Trans., vol. xvi., p. 164.

from some of the cases of congenital hydro-nephrosis has contained little or no urea. In the specimen supplied from Mr. Hay's case, Dr. Prout found at first only faint and somewhat doubtful traces, but after the fluid had stood several days these became distinct. An acid principle was also detected, which Dr. Prout thought somewhat resembled the allantoic in some of its properties, though it differed from it in others. In Dr. Kennedy's case, no trace whatever of urea could be found in the fluid removed either from the bladder or kidney, notwithstanding a most careful analysis. In a case of fœtal hydro-nephrosis reported by Dr. Madge,* the fluid contained in the renal sacs had no urinous odour on boiling, and unsuccessful attempts were made to find urea and uric acid in it. Dr. Madge considers that this result goes indirectly "to prove the absence of urea in the fœtal system; for, notwithstanding that the child had been vigorous and was well developed, there had for some considerable time been no kidneys to separate urea from the blood." This opinion is not supported by the case in question. Fœtal, like extra-uterine life, may be possible for a time with very little or no renal tissue, owing to the vicarious activity of skin and bowels; but death shortly supervenes. Nor must it be hastily inferred, from analysis made after death, that urea is not commonly formed in the fœtus. It is possible that in congenital hydro-nephrosis, owing to the sacculated condition of the kidneys, urea is no longer excreted by them, but is, instead, removed from the fœtus by the blood of the mother. Moreover, it seems probable that if the quantity of urea in the retained fœtal urine is greater than that in the fœtal blood, it will be removed in the same manner, until at last all, or nearly all, the urea disappears from the urine of the hydro-nephrotic cysts of the fœtus.

* Trans. Obstetrical Soc., vol. xi.

It may reasonably be inferred, from the large number of hydro-nephrotic fœtuses which are either still-born or die soon after birth, that the removal of urea from the fœtal circulation is insufficient, and that as a consequence death generally occurs, and that too by way of uræmia. Again, in answer to the argument that urea is absent from the fœtal system, there are the results of analyses, such as Brande's and Prout's, whereby urea was shown to be present in the urine of hydro-nephrotic fœtuses.

There are three features of considerable interest in connection with congenital hydro-nephrosis, viz. (1) the mechanical interference with parturition, (2) the frequent association of congenital hydro-nephrosis with other deformities and malformations, and (3) the elimination of urine in the fœtus. Though these do not fall strictly within the scope of this book, I shall perhaps be pardoned for introducing a few remarks on points of such interest.

1. The size of the abdomen of a fœtus affected with hydro-nephrosis has been a serious impediment to labour in several cases. In 1863, Dr. Braxton Hicks exhibited at the Obstetrical Society two fœtuses, each of which had so complicated delivery as to necessitate the use of the crotchet. In some cases there is reason for believing that the movement and compression of the fœtus during labour has led to the discharge of the urine into the sac of the amnion before delivery could be naturally completed. Thus, in Dr. Simpson's case, a young woman who had previously borne children, was delivered of an infant at full time, the belly of which "bore a striking resemblance to the belly of a woman who had just been tapped for a large unilocular ovarian dropsy, with the walls attenuated and flabby, and bulging out on either side between the ribs and crest of the ilium." The mother remarked that a very small quantity of

liquor amnii escaped before the birth, which was, however, easy and rapid, but that after the escape of the body of the child there came a large gush of water. The child micturated freely shortly after birth, and lived to the twentieth day. At the post-mortem examination both kidneys and their ureters were found greatly dilated, and the bladder was considerably hypertrophied, and evidently had been enormously distended.

It cannot fail to be useful to the practitioner to know that congenital hydro-nephrosis may give rise to tedious and protracted labour, and may even render parturition impossible until the abdomen of the child has been reduced by tapping.

2. The second point of interest connected with these cases is the frequency with which they are associated with other congenital deformities and malformations. Hare-lip, club-foot, some abnormality of the anus or intestine, or some malformation of the external genital organs, have often been found in the subjects of congenital hydro-nephrosis. In Dr. Simpson's case the feet were clubbed; in Hay's case (reported by Dr. Lee), a still-born hydro-nephrotic female infant had impervious ureters, double hare-lip, and two clubbed feet. In Billard's case, a still-born male had many defects of development in rectum, urethra, and prostate. In one of Howship's cases, a male infant born alive at the eighth month, the feet were distorted, the anus imperforate, and the lower part of the belly was occupied by a large circumscribed tumour. The child died the same evening; the kidneys and ureters, as well as the bladder, were found excessively distended by urine; the bladder, though it had attained an extraordinary degree of thickness and strength, had given way posteriorly, where a large cyst or pouch was formed; and the natural structure of the kidneys had entirely disappeared.

In my own case, referred to above, there was an absence of part of the rectum, and a cul-de-sac in place of an anus.

It has been with double congenital hydro-nephrosis chiefly, though not exclusively, that these various malformations have been associated. The frequency of this association is of importance to the practical surgeon, as well as of interest to the pathologist; for when considered side by side with the fact that malformed and misplaced kidneys are also often associated with such malformations, it teaches us to suspect renal imperfections, and to beware of nephrectomy, in one who has *any* visible or ascertainable defect or error of development.

3. The third point to which I have referred is the important physiological fact that congenital hydro-nephrosis proves, namely, that the secretion of urine goes on to a very considerable extent during the latter half of intra-uterine gestation; and that when any obstacle to the outflow of urine exists the same pernicious effects of distension of the bladder, ureters, and kidneys occur before birth as are commonly known to arise from urethral stricture, calculus, and other causes of obstruction after birth. The co-existence of congenital hydro-nephrosis and of some mechanical obstruction in the urinary passages has been far too frequently observed to be a mere coincidence, and there is no escape from the conclusion that the hydro-nephrosis is a direct result of the retention. The conclusion to be drawn from this is, that during the latter part of gestation there is a discharge of urine from the fœtal bladder into the cavity of the amnion. There is a pretty general agreement amongst physiologists that the secretion of urine begins soon after the formation of the kidneys, viz. between the fourth and fifth month; but systematic writers have been all but silent on the question as to

what becomes of the urine secreted prior to birth. The subject had not been overlooked, however, by several of those who have reported cases of congenital hydro-nephrosis, for we find Drs. R. Lee, Prout, Kennedy (of Dublin), M. Billard, Howship, and Graily Hewitt, as well as some of the older writers, expressing their belief that the liquor amnii is more or less composed of the urine of the child, and that in a fœtus with normal kidneys the urine is constantly passing through the bladder to the cavity of the amnion. The presence of urea and some of the other urinary constituents in the amniotic fluid confirms this view.

The results of analyses seem to show that before the commencement of the sixth month very little, if any, urine mixes with the liquor amnii; but after that period urea has been found in the amniotic fluid by Drs. Prout, Owen Rees, Flint, A. Gusseron, Bernard, Robin, Beaunis, and Wöhler. Berzelius* refers in detail to what he thought the most complete analysis of liquor amnii which had been made up to that time, and from which it appeared that urea, benzoic acid, much chloride of sodium, phosphate and sulphate of soda, sulphate of lime, and traces of the salts of potash were found. Berzelius regarded the discovery of urea in the liquor amnii as a proof that the urine of the fœtus flows into and mixes with that fluid. Dr. Owen Rees† gave a detailed report of the analysis of four specimens of liquor amnii obtained pure at the seventh and a half month of gestation; urea, lactic acid, chloride of sodium, and traces of alkaline sulphates and phosphates were contained in each of them. In one specimen the amount of urea was 4·4 in the 1,000 parts; the average quantity was 2·6 per 1,000 parts.

Flint, from a number of analyses by different

* "Traité de Chimie," tome vii., pp. 564-6. 1833.
† Guy's Hospital Reports, 1838.

chemists gives from 2 to 3·5 per 1,000 parts as the proportion of urea.

In the year 1876, Mr. William Foster, the lecturer on chemistry at the Middlesex Hospital, undertook for me the analysis of several specimens of liquor amnii. My wish was to ascertain the composition of liquor amnii during the different months of the latter part of gestation. But owing to the difficulty in getting the requisite samples, and the uncertainty as to the value of the analytical numbers obtained, Mr. Foster was compelled to let the investigation cease after many months' work. Although my original object was not attained, Mr. Foster has furnished me with the results of his analysis of thirteen samples of liquor amnii at the full period of gestation; these show that urea is a normal constituent of that fluid, and give an idea of the percentage amount present. The following are proximate analyses of four differing samples:

Date of receipt of sample.	Dec. 22, 1876.	Dec. 30, 1876.	Feb., 1877.	May 15, 1877.
Total dissolved solids dried at a temp. of 212° F., per cent.	1·118	1·184	1·099	1·314
Saline matter obtained by ignition of the total solids, per cent.:	0·754	0·762	0·724	0·801

In all cases the identification of the urea consisted in the production and examination of microscopical quantities of the nitrate. The estimation of its amount was carried out as follows: A measured quantity of the liquor amnii was made slightly acid by means of acetic acid, and evaporated to a small bulk in a porcelain dish on a steam bath. Some

strong spirit was next added. The whole was then thoroughly stirred and afterwards carefully filtered. The filtrate was evaporated to a small bulk on the steam bath, and then treated with an excess of alkaline hypo-bromite. From the volume of nitrogen gas liberated the quantity of urea was calculated.

The mean of these thirteen determinations of the percentage amount of urea in liquor amnii is 0·035. The lowest 0·018, and the highest 0·062. Healthy blood contains 0·0159 per cent. of urea.

It would, perhaps, be incorrect to infer that these analyses give a full idea of the quantity of urea poured into the liquor amnii. It is reasonable to suppose, that owing to the crystalloid property of urea some of it is constantly passing off from the cavity of the amnion into the maternal circulation; and that in this way, if urea was not excreted by the fœtal kidneys, it might altogether disappear from the liquor amnii.

The conclusions to which congenital hydro-nephrosis and the analysis of liquor amnii points, are:

(1) That urine is secreted in considerable quantity during intra-uterine life.

(2) That this quantity is far too large to be stored up in the normal urinary passages of a fœtus.

(3) That during the latter part of gestation urine is passed off through the urethra of the fœtus into the sac of the amnion.

(4) That in some cases of congenital hydro-nephrosis urea has been absent from the urine; because, probably owing to the obstruction, merely the water and salines of urine were secreted.

(5) That the quantity of urea in liquor amnii is small, but in the later stages of gestation fairly constant.

(6) That the presence in liquor amnii of urea and other constituents of normal urine gives support to the inference drawn from cases of congenital

hydro-nephrosis, namely, that the fluid of the amnion is, in part, *at least*, composed of the urine of the fœtus.

The late Dr. Swaine Taylor pointed out that there is a gradual decrease in the proportion of albumen in liquor amnii as pregnancy advances. Thus, he stated that from 10·77 per cent. in the fourth month it diminishes to 0·82 at the ninth month. This alone would have suggested that the amniotic fluid is constantly undergoing change by admixture with some non-albuminous fluid such as urine.

CHAPTER XXIII.

PYO-NEPHROSIS.

By pyo-nephrosis is understood dilatation of the pelvis and calyces of the kidney with pus, or pus and urine. It is a mechanical result of obstruction, and something more. It is hydro-nephrosis with pyelitis superadded. Sometimes the amount of pus is so small, the pyelitis so slight, and the amount of pent-up urine so large, that the tumour is called hydro-nephrosis rather than pyo-nephrosis, in spite of the presence of pus. But in all cases where there is suppuration as well as dilatation of the pelvis and calyces of the kidney, the condition is, strictly speaking, pyo-nephrosis.

In advanced cases, the dilatation and suppuration extend beyond the calyces and go on to the compression, atrophy, and breaking down of the medullary and cortical substance, until at length the whole kidney is converted into a large and loculated sac. This sac contains pus, or purulent urine, or urine mixed with muco-pus in larger or smaller quantity; or pus and urine mixed with blood; or a white phosphatic deposit

or mortary paste of phosphate of lime; or débris of renal calculi; according to the cause of the obstruction.

Etiology.—Hydro-nephrosis becomes pyo-nephrosis as soon as suppuration occurs; and therefore the causes which produce pyo-nephrosis may be the same in their nature as those which give rise to hydro-nephrosis. But when an obstruction causes pyo-nephrosis at once, it is more complete in its character, and more rapid in its irritative effects upon the kidney, than when it causes hydro-nephrosis first. When pyo-nephrosis is the primary effect, the kidney has not had time, as in hydro-nephrosis, to go on gradually dilating and gradually atrophying whilst the other kidney *pari passu* is taking on compensatory hypertrophy; but inflammation of the renal pelvis is at once, or very quickly, lighted up by the same cause which checks the outflow of the urine.

In some cases of pyo-nephrosis, the pyelitis, instead of following, has preceded the obstruction. When pyelitis has preceded, the cause of the obstruction is either a product of the inflammation of the kidney, or is the same as that which excited the pyelitis. As a result of pyelitis, a clot of blood, or inflammatory infiltration of the mucous membrane around an ulcer, or a little mass of inspissated pus or muco-pus, or a fragment of diphtheritic, cancerous, tuberculous, or semi-organised false membrane, or white pultaceous matter containing more or less gravel, may block the ureter. A vesical calculus or growth, or a cancer of one of the pelvic organs, may be the cause both of the suppuration and the obstruction; causing, first of all perhaps, cystitis, and then pyelitis, by extension upward, along the ureter, of the inflammatory process; and afterwards giving rise to obstruction by involving and occluding the lower end of the ureters. Or it may be that the pyelitis is excited directly by reflex irritation, and independently of cystitis.

To enumerate all the various causes of pyo-nephrosis, therefore, would be to give a complete list not only of the causes of hydro-nephrosis, but of acute and chronic pyelitis also. The most frequent cause of pyo-nephrosis is calculous pyelitis; indeed, renal calculus is so largely in excess of other causes that it has been implied, if not explicitly stated, by some writers, that pyo-nephrosis and calculous pyelitis, when it assumes the dimensions of a renal tumour, are one and the same thing. This, however, is not the case. Moreover, it must be borne in mind that very marked, and, indeed, fatal, pyo-nephrosis may exist without giving rise to any palpable tumour during life, as the subjoined particulars prove.

During the ten years ending 1883 the post-mortem records of the Middlesex Hospital contain thirty-six cases of pyo-nephrosis, unaccompanied by suppurative nephritis, from causes other than stones in the kidney.

Cancer of uterus and vagina in	13
Stricture of urethra	4
Cyst of ovary	2
Uterine fibroid	1
Epithelioma of penis	1
Abscess in bladder walls and cystitis	1
Stone in bladder	1
Villous disease of bladder	2
Sarcoma of bladder	1
Cause of obstruction not stated in	10

Of the ten cases in which the cause of the dilatation is not stated there was injury or disease of brain or spinal cord in seven, heart disease in one, Bright's disease in one, and cancer of the breast in one.

In the majority of these cases the pelvis of the kidney is stated to have been "much distended," or "distended and full of purulent urine," or the kidney

was found "reduced to a membranous sac, dilated and divided into compartments," etc. In only one of them, however, was there a renal tumour of any great size.

This was in a man, æt. 39, and its cause was stricture of the urethra. The right kidney was enormously dilated, and formed a tumour which extended from the liver to the pelvis; its secreting substance had almost disappeared; its capsule was adherent to the surrounding parts; and its interior was loculated and lined by a slaty grey-coloured membrane. The left kidney was in a similar, but less advanced, state.

In twelve other cases pyo-nephrosis was complicated with well-marked suppurative nephritis.

The causes of the disease in these cases were:

Cancer of the uterus and vagina . . .	2
Epithelioma of bladder	1
Stricture of urethra, with cystitis . . .	5
Vesical calculus, with cystitis	1
Enlarged prostate, with cystitis. . . .	1
Tubercular disease of bladder and kidneys	1
Cause unstated	1

In nine out of the twelve cases the disease affected both kidneys.

Of sixteen cases of renal calculi observed during the same period there was pyo-nephrosis in eleven. In three of the eleven the kidney was extremely sacculated. In a fourth it was converted into a membranous sac, the lower half of the organ being wholly membranous, whilst the upper half retained only a slight trace of renal tissue. In a fifth the left kidney had lost all its glandular substance, was enormously distended, loculated, and filled with pus and many uric acid calculi, and formed a tumour 6½ inches long and 9 inches in circumference; the right kidney was enlarged, but healthy; the bladder was inflamed,

and had phosphatic deposits upon its lining membrane. The patient was a man, æt. 60, who died of the pyo-nephrosis and pelvic cellulitis.

Dr. Dickinson tabulates ten cases of pyo-nephrosis; in six of them there was calculus in the affected kidney, in two the cause was stricture or obliteration of the ureter, and in two the cause was not ascertained.

Strumous diseases of the kidney occasionally lead to blocking of the ureter and dilatation of the pelvis of the kidney; but these cases are characterised rather by the caseating depots in the substance of the kidney than by atrophy of the glandular substance and distension of the calyces.

Dr. Ewart records a case of sacculation of the lower half of each kidney. Each kidney possessed two ureters. The cause of the obstruction was found to be tubercular disease of the two lower ureters. (*See* hydro-nephrosis, page 301.)

The cause of pyo-nephrosis is not always ascertained; it was not in Mr. Clark's case of distension of half a horse-shoe kidney (Fig. 24).

Mr. Erichsen mentions gonorrhœa as an occasional cause of pyo-nephrosis, and alludes to a case in which an abdominal tumour was thus formed. The cyst was twice tapped, a large quantity of pus being withdrawn each time; the tumour did not reappear after the second tapping. Rayer speaks of gonorrhœa as being a much more common cause of pyelitis than the majority of physicians suppose.

Pyelitis followed by pyo-nephrosis sometimes results from wounds and contusions in the renal region. A case of an enormous pyo-nephrotic cyst from injury to the loin occurred in a boy, aged sixteen, who was admitted into the Middlesex Hospital under the late Dr. Murchison.* The tumour, which was of the right

* *See* Murchison's "Lectures on Diseases of the Liver," p. 115.

side, first showed itself about eight months after the injury. During the greater part of this interval the boy was confined to his bed, and suffered from vomiting and occasional convulsions of the opposite side of the body. Four months after the first appearance of the tumour he regained his health and continued well, though the swelling went on slowly increasing for seven years. After getting wet through one day he was seized with severe pain in the back, and febrile symptoms. On admission there was no anasarca and no albumen in his urine, but there was great anæmia with emaciation and dyspnœa; and the abdomen measured thirty-three and a half inches at the umbilical level, the bulging being greatest in the flank. One hundred and seventy ounces of fluid were drawn off from the tumour, the last two pints consisting largely of creamy pus. The operation was followed by immense relief, but the boy died nine days afterwards of prostration, and pleurisy at the base of the left lung which had existed before the operation.

Morbid anatomy. — When pyelitis, whether acute or chronic, is associated with retention of urine within the renal pelvis, the mucous membrane by degrees assumes a dull white colour, very different from the bluish-white semitransparent colour of health, is markedly thickened, and secretes a quantity of pus. The pent-up urine soon becomes alkaline from admixture with the pus, the urea is converted into carbonate of ammonia, and calculous material is often deposited upon the lining membrane of the organ. The thickening of the mucous membrane is sometimes so marked, and the dilatation and distension of the calyces and pelvis so considerable, that the orifices whereby the pouch-like dilatations of the calyces communicate with the pelvis become excessively narrow, occasionally altogether closed, by fibrous dissepiments or partitions. As the distension of the cavity of the kidney

proceeds, the pyramids, and then the cortex of the kidney, become more and more atrophied, until at length all the glandular tissue is completely removed

Fig. 21.—Kidney in an advanced state of Calculous Pyo-nephrosis. (Middlesex Hospital Museum.)

and the organ is transformed into a multilocular or many-chambered cyst, the pouches of which communicate with one another only indirectly through the (often enormously) dilated pelvis.

The relation and connection of the cyst with the structures surrounding it vary. Sometimes it forms adhesions on all sides, with the liver or spleen above,

with the small intestines on the inner side, with the ascending or descending colon in front or on the inner side, and with the deep structures of the abdominal parietes behind and on the outer side. The surrounding parts are displaced in proportion to the size of the tumour; if of considerable size the cyst may push up the liver or spleen some inches, as well as displace the intestines inwards, and the parietes at the loin outwards and backwards. Ulceration of the cyst wall, or suppurating tracks formed through what remains of the renal substance, sometimes end in fistulous openings into the parts around; it may be into the cellular tissue of the loin, or into the stomach, duodenum, colon, or peritoneum. Sometimes only one, sometimes several fistulous openings occur in the same case. As soon as a fistula forms, the purulent urine escapes and gives rise to perinephritis, peritonitis, or the discharge of pus and urine by the mouth or rectum, or through the loin. A fistula may form, as a consequence of pyelitis, before the calyces and pelvis have become much dilated, or the kidney otherwise enlarged; but, except in scrofulous kidney, atrophy of the renal substance, and more or less complete retention of pus or purulent urine in the cavity of the kidney, generally precede renal fistulæ.

In pyo-nephrosis of the left side, the cyst wall may form adhesions directly with the diaphragm; and if the diaphragm becomes adherent to the base of the left lung a fistula may open directly through the muscle into the lung. Rayer saw urine and pus from the left kidney expectorated in this manner.

The fluid contained in the distended kidney is occasionally pus with blood, or pus so concentrated that there is scarcely a trace of urine. If it has become changed by decomposition and the development of ammonia, it is more or less thready and glairy. At other times it is a soft mortary material, of a white or

yellowish-white colour, and of the consistence of butter.

When a calculus is formed in the kidney it has often assumed a branched form which exactly fits the pelvis and calyces; in other instances, one calculus blocks the ureter, and more or less fills the pelvis, whilst other independent calculi occupy one, two, three, or more of the calyces. (*See* Figs. 22 and 23.)

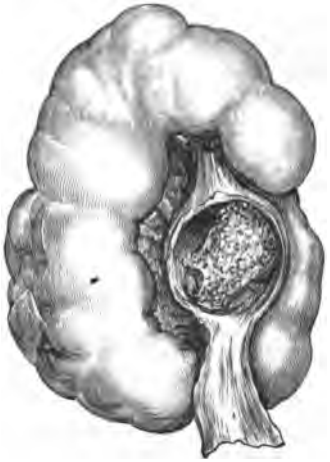

Fig. 22.—Kidney, the Pelvis of which is blocked by a Calculus.

The chambered and enlarged cavity of the kidney was filled with thick greenish pus and calculous material. (From specimen in St. George's Hospital Museum.)

It does not always happen that a calculus, which is large and branched, occupying pelvis and calyces too, obstructs the urine altogether, even though the mucous membrane of the pelvis and calyces is much inflamed. In such cases the kidney does not become enlarged. On the other hand, when a much smaller stone is tightly impacted in the ureter the kidney is likely to suffer a much more general pyelitis and to be rapidly distended with urine mixed with mucus, pus, and blood.

In some cases the kidney becomes completely sacculated and loculated, and left without a trace of glandular tissue; but the organ, instead of being enlarged, is actually reduced in size below normal, owing to shrinking of the cyst.

Symptoms.—In the early stages the symptoms of pyo-nephrosis will be those excited by the cause of the obstruction, whatever that may be; and, in addition, those of pyelitis. If the obstruction is not complete there will be pus in the urine; if complete, but intermittent, there will be intervals when no pus is discharged; whilst if the obstruction is both complete and permanent there will be an entire absence of pus in the urine.

Fig. 23.—The same Kidney as shown in Fig. 22.

It has been converted into a chambered cyst six or seven times larger than the normal kidney, with thick fibroid walls and septa. Lithatic calculi are contained in the chambers and embedded in the septa. The cavities in the recent state, as well as part of the ureter, were filled with pus. From a man, aged 43, who died of œdema glottidis. (From specimen in St. George's Hospital Museum.)

There will be constitutional symptoms of suppuration; sometimes shivering, sometimes a high temperature at night without rigors; emaciation, great prostration of strength, loss of appetite, perhaps sickness and diarrhœa, and often a dusky pallor or sallow tinge of skin. When the pyelitis is very chronic and severe there may be all the symptoms of hectic.

When a tumour forms in one or the other loin it possesses the same characters as a hydro-nephrotic tumour. It is elastic or fluctuating, or nodulated and hard, and bulging backwards into the flank as well as occupying more or less of the abdomen. If the tumour is not large there will be no actual prominence

or bulging of the loin, but merely a slight fulness, or it may be even only just the loss of the natural incurvation of the region. As the kidney becomes more distended and enlarged, the flank becomes more and more prominent until at length a tumour can be both seen and felt projecting the abdominal walls of the ilio-costal space outwards and backwards. When it is of very large size the tumour may reach the iliac fossa, or even Poupart's ligament or the hypogastrium, and may weigh from ten to thirty pounds or more. On percussion there is dulness in the flank and frequently for some distance forwards; but the extent of anterior dulness varies, because if the colon is distended with flatus there may be resonance for some distance outwards as well as over the front and inner side of the tumour.

Unless pyo- or hydro-nephrosis occurs in a movable or horse-shoe kidney, as is sometimes the case, there is always dulness posteriorly. When the tumour is not of great size there may be a line of resonance above it, on the left side between it and the spleen, and on the right side between it and the liver; but if it be of considerable dimensions it may have formed adhesions with the under surface of the liver or spleen, and so simulate a tumour or hypertrophy of one or other of those organs. If very large the tumour has almost always a more or less nodulated or lobulated outline; when this is the case and fluctuation is also distinct, hydro- or pyo-nephrosis is clearly indicated.

The pain experienced depends greatly on the size of the tumour; there are in some cases paroxysms of great severity. Pressure over the front of the tumour nearly always aggravates pain; or provokes it if it was not present before. Pressure over the flank, in some cases, is not only well borne but actually gives relief.

The urine should be carefully and frequently examined. If the ureter is completely blocked, the

total quantity of urine excreted for a short time, at least, after the occlusion, will be markedly diminished in quantity. If partially blocked the quantity of pus and urine will vary from time to time, even during the same day. If the cause of the obstruction shifts so that the ureter, from being quite blocked at one period, becomes patent at another, large quantities of purulent bloody urine will be passed during the patency periods, the urine in the intervals of occlusion being quite clear and natural, provided the opposite kidney is healthy. In the case of pyo-nephrosis in one half of a horse-shoe kidney, from which Fig. 24 was taken, the patient, seven years before his death, complained of severe abdominal pain and constipation. Fourteen days after the onset of these symptoms there was a rise in his temperature, and two days later, when at stool, he felt something give way in his belly. On the day but one after this sensation a large quantity of pus was passed in his urine (one-fourth to one-third); pus continued for a few weeks, and then ceased. He began to feel quite well as soon as the pus began to pass. The patient died, aged 55, of syphilitic disease of the brain; but though his urine during the seven years' interval was several times examined, it was not purulent. At the post-mortem examination the left part of the kidney was distended with pus.

When the cause of the obstruction is intermittent in its action, the lumbar tumour will diminish, or may even disappear altogether after the discharge of pus.

It is always necessary, therefore, to watch the urine continuously and carefully, having the total quantity passed during twenty-four hours collected and measured. It must be remembered that the urine, from the suppurating pelvis of a kidney, may be glairy and alkaline. In simple pyelitis there may be more or less dysuria, but the urine contains pus without any

appreciable mucus; whereas in cystitis, commonly though not invariably, there is glairy mucus often in large quantities mixed with the purulent urine.

In pyelitis, associated with renal obstruction, the urine decomposes in the calyces, becomes alkaline and then glairy, like the urine in cystitis, though the urine from the affected kidney, being mixed with that from the opposite kidney, is less markedly glairy even in these cases than in cystitis.

In cases in which the opposite ureter is already blocked or the kidney destroyed, complete anuria and death take place. Anuria has been known to occur when one kidney only was obstructed.

If suppression of urine is prolonged beyond three or four days a fatal issue must be looked for; though from the number of cases in which life has been continued over nine days and longer without the secretion of a drop of urine,* we are encouraged to hope even against hope in the employment of remedies for the stimulation of the kidney to fresh secretion, or of nephrotomy to take off intrarenal pressure.

Diagnosis.—It is very necessary in pyo-nephrosis, as in hydro-nephrosis, to correctly diagnose the nature of the tumour, because the operative treatment (nephrotomy), which is so beneficial in them, might be disastrous in tumours of a different nature.

The tumours which may be mistaken for pyo-nephrosis are thus enumerated by Rayer: "On the left side of the abdomen, all those which result from morbid enlargement of the spleen; on the right side the tumours of the liver and gall bladder; on either side the various renal tumours of another nature, such as hydro-nephrosis, hæmorrhage into the cavity of the pelvis, cancer of the kidney, tubercle, kidneys containing hydatid cysts; extrarenal abscess either idiopathic

* Dr. Shroff, of Calcutta, has recently reported such a case; *Lancet*, Dec. 20, 1884.

or consecutive to perforation of the kidney or of the colon or cæcum; abscess arising from caries of the spinal column; tumours of the suprarenal capsules; aneurysms of the aorta; encysted tumours of different contents, hydatid or otherwise; and lastly, fæcal tumours from the accumulations of fæcal matter in the colon or cæcum."

For the distinguishing characters of these I must refer the reader to the chapters on diagnosis of renal tumours, hydro-nephrosis, and perinephritic abscess.

It must suffice here to state that pyo-nephrosis is nearly always preceded and accompanied with febrile symptoms; the tumour is more or less painful, and the pain is increased by pressure over it, and by movements of the trunk; and when the ureter is not absolutely occluded there is the presence in the urine of more or less pus.

When pyo-nephrosis affects a horse-shoe kidney, as in the case illustrated in Fig. 24, there may be no tumour, and the diagnosis may be impossible. It was so in the case from which the accompanying drawing was taken.

In hydro-nephrosis there is an absence of febrile symptoms and of pus in the urine. In perinephric abscess there is even more pain than in pyo-nephrosis, the course of the fever is more severe and rapid, and fluctuation succeeds to ill-defined hardness about the loin and iliac region, and not to a gradually developing circumscribed tumour. In perinephric abscess there is extreme tenderness before there is any sign of fluctuation or elasticity, the thigh is often flexed upon the abdomen, and cannot be extended without great pain; and there is generally redness and œdema of the skin of the loin; there is no pus in the urine; and when pus has formed in the circumrenal tissue, fluctuation is more easily made out, and is more superficial than in pyo-nephrosis.

It is from hydro-nephrosis and perinephric abscess

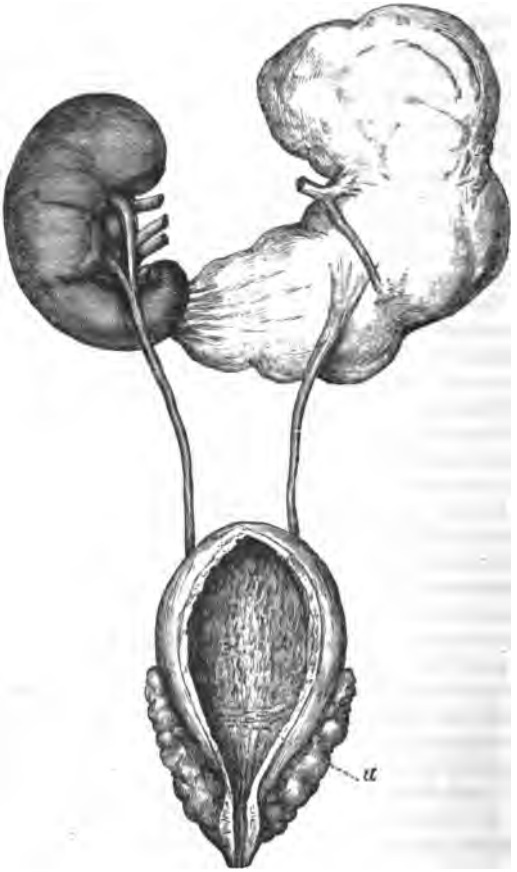

Fig. 24.—Horse-shoe Kidney, the left half of which was converted into a large cyst containing pus. (Middlesex Hospital Museum. Presented by Mr. Clark.)

that the diagnosis of pyo-nephrosis is certainly most difficult, and fortunately it is of less consequence if a mistake is made between them than in most other cases, because a lumbar incision with a view to nephrotomy would give vent to the pus of a perinephric abscess, and nephrotomy is equally advantageous for hydro-nephrosis as for pyo-nephrosis. In opening a peri-nephric abscess, if the discharge has any of the characters of urine it will be safe to infer that there is disease within the kidney. Sometimes the sequence of the clinical symptoms will have indicated that pye-litis or pyo-nephrosis preceded the acute symptoms which culminated in perinephric abscess. In other cases a digital examination of the wound will disclose the diseased condition of the kidney, perhaps even a perforation in its capsule. Under these circumstances the surgeon would open the kidney, as in hydro-nephrosis or pyo-nephrosis.

If, on the other hand, no symptoms which suggest disease of the kidney itself, such as nephritic colic, or the passage of blood or pus with the urine, have pre-ceded or accompanied the formation of the swelling in the lumbar region; and if the kidney, with the finger in the wound, is felt to be of normal size and character, there will be no reason to suppose that the case is other than an abscess in the perinephric tissue un-complicated at least by renal disease.

It must, of course, be understood that the diagnosis should be pushed not only to the making out of the nature of the tumour, but also of the character of the obstruction which has led to the renal distension. To this end the urethra, prostate, and bladder must be carefully interrogated; and the various parts of the abdomen and pelvis must be examined so as to detect or exclude the several extrinsic causes of occlusion of or pressure upon the ureter. It would seldom be necessary to perform nephrotomy for an accumulation

of urine or pus on the pelvis and calyces of the kidney if the distension has been caused by cancer of the penis, stricture of the urethra, enlargement of the prostate, paralysis of the bladder, a stone impacted in the vesical orifice of the ureter, or by an ovarian cyst or other form of tumour which was itself removable.

Prognosis.—To a considerable degree the prognosis depends on what has caused the renal distension. In cancer of the pelvic organs, suppuration in the vesical walls, the impaction of a calculus in one ureter with disease of the opposite kidney, in all these cases and such as these, the fatal prognosis is decided by the nature of the determining cause. When, however, pyo-nephrosis of one side only is produced in persons with previously healthy kidneys, by some cause which occludes the ureter and does not interfere with the opposite kidney, the prognosis, as regards life, at least, is good, if early relief to the pent-up urine and pus be given; otherwise the tumour will cause death by dyspnœa or other effects of pressure, or will burst at the surface of the body and give rise to a permanent fistula in the loin or groin; or into the colon or small intestine, the stomach, or through the diaphragm into the pleura or a bronchus, and death will occur sooner or later from exhaustion, diarrhœa, vomiting, blood poisoning, empyema, or suffocation; or, again, it will burst into the peritoneum and cause death rapidly by peritonitis, or slowly after having formed a circumscribed peritoneal abscess.

Dr. E. H. Bennett,* of Dublin, showed a left kidney, on the anterior surface of which a small opening allowed pus to escape freely into the peritoneum from a large abscess due to distension of the pelvis of the organ by a calculus impacted in the left ureter. The bladder showed signs of acute cystitis. The man (a sailor) had seventeen months before had an injury

* *British Medical Journal*, p. 361; March 13, 1875.

to his perinæum (probably ruptured urethra), and numerous small calculi "came away through a stricture of the urethra."

The most favourable result is when the obstruction gives way and does not recur, and the contents of the tumour discharge themselves along the ureter. Even in this case the affected kidney may be permanently damaged and continue for the rest of the patient's life to discharge pus as well as secrete urine. In such circumstances death from lardaceous disease may take place unless the suppurating cavity is removed by nephrectomy.

Treatment.—Prior to the formation of a tumour the development of pyo-nephrosis can only be conjectured by the presence of pus in the urine and the associated symptoms due to the obstructing cause. If the obstruction prevents altogether the downflow of the contents of the kidney, there will be nothing but the diminution in the daily quantity of urine to indicate distension of the cavity of the kidney, and the question whether the fluid retained therein is urine or urine and pus can only be answered by the presence or absence of febrile symptoms.

In the early stages of pyo-nephrosis the treatment therefore consists of the removal, if possible, of the cause of the distension; and in the improvement of the pyelitis.

If the cause is a removable or remediable one, such as stricture of the urethra, prostatic enlargement, etc., the attention of the surgeon must be addressed to it. Tumours of the ovary, uterus, and of the bladder, should be removed when possible. If a calculus could be felt in the vesical orifice of the ureter, it should be extracted, and in certain cases in which there were strong grounds for believing that the cause of the obstruction was a calculus impacted in the ureter, too high to be felt from the bladder, and

too low to be reached through the kidney, abdominal section, followed by the excision of the impacted calculus, will be justifiable and right treatment. When the cause of the obstruction has not long existed, and is probably due to a small calculus or a plug of mucus, pus, blood, or false membrane in the ureter, it may be displaced by friction or manipulation of the tumour, if one exists; by freely drinking hot liquids, such as tea, or by active and jolting exercise, such as prolonged riding on horseback or in a carriage. It must be observed, however, that pressure, if the tumour is painful, cannot be borne; moreover, it would probably be really harmful, by increasing the inflammation, or by rupturing the cyst. Palliative treatment of the tumour is permissible when there is not complete obstruction, and the pus and urine can escape by the ureter; when there is neither fever, hectic, diarrhœa, emaciation, nor pain, and the tumour is not of such a size as to threaten rupture; when the tumour, from having been of large size, has diminished, by the emptying of the cyst along the ureter into the bladder; when the surrounding organs and tissues are not excited to inflammation; and when the advanced age of the patient, or some serious complication of bladder, uterus, or other organ of the body, renders any operation a danger in itself.

Under these circumstances we shall help to diminish the suppuration, and prevent the occurrence of acute inflammatory action in the cyst, by rest in bed or on the couch, frequent hot baths, anodyne and emollient applications to the loin and abdominal walls, gentle compression by belladonna plasters, the avoidance of constipation and the accumulation of fæcal matter in the colon and cæcum, and by a light digestible diet, properly regulated according to the constitution of the patient. Blood-letting is sometimes

recommended, and has been in times past largely practised in calculous pyelitis; but in most cases it must not exceed the application of a few leeches over the tumour to relieve or obviate any exacerbation of pain.

In many instances, however, the only proper treatment is nephrotomy, palliatives being useless, and delay in operating dangerous. The circumstances which indicate nephrotomy are constant pain, increasing size of the tumour, continued fever and evening elevations of temperature, serious interference with the functions of the stomach and intestine by reflex irritation or direct pressure of the tumour; when the surrounding structures are inflamed, or becoming adherent to the tumour, and when the tumour threatens to rupture or ulcerate into them.

When the contents of the distended kidney have infiltrated the perinephric cellular tissue, and set up perinephritis or perinephric abscess, there is increased reason for the lumbar incision. The depth at which the pus is situated from the surface, the length of time requisite for the parietal tissues to become thinned by the suppurative process, and the comparative readiness with which the abscess can open into the peritoneum, or, at any rate, in some direction less favourable than externally, render waiting for pointing, or even evident fluctuation, most injudicious.

The operation gives great and instant relief, and in individuals with fairly good constitutions it may be said to be quite free of danger. The steps of the operation are described under "the surgical operations on the kidney." What has been said under the treatment of renal abscess respecting the shutting off of one abscess space from others, and of the necessity of opening each large suppurating chamber, should be borne in mind in operating on a case of pyo-nephrosis.

After opening the kidney, the interior of the loculated cyst should be examined with the finger,

and with the probe and sound, in order to ascertain the presence or not of a calculus in the pelvis or upper end of the ureter. This procedure ought not to be omitted.

If a calculus be found it should be removed, either entire, or after breaking it into fragments with necrosis forceps or a lithotrite. The extraction, though sometimes difficult, may be generally effected by forceps, or the curette and finger; sometimes with a blunt hook the calculus may be drawn into a part of the cyst from which it can be more easily extracted, or even quite towards the external wound. If no stone is felt at the operation, a fresh exploration through the fistulous opening should be made at some subsequent time. When the fistulous opening remains permanent, and a considerable quantity of pus is daily discharged through it, especially if the matter discharged is very offensive, or when lardaceous disease threatens, nephrectomy should be performed.

Lumbar nephrectomy for pyo-nephrosis has been several times followed by good success.

CHAPTER XXIV.

ACUTE AND SUBACUTE INTERSTITIAL NEPHRITIS.

Acute and subacute interstitial inflammation, without suppuration, may affect the whole or only a part of each kidney. As a rule, both kidneys are affected, though frequently to an unequal extent.

Causes.—This form of nephritis may be brought on by any of the causes of obstruction which have been enumerated under hydro-nephrosis, or by reflex irritation, excited by some simple operation, such as the introduction of a catheter or sound; and it is

more especially prone to occur if the kidney, having been previously subjected to undue pressure, is excited by reflex irritation, as, for example, by passing a catheter in a case of long-standing prostatic enlargement.

Symptoms.—The mode of onset of acute or subacute interstitial nephritis varies with the cause. When excited by the introduction of an instrument, or by a surgical operation, the disease will generally commence with a distinct rigor, or with a succession of slight chills which may be continued at intervals throughout the attack. When due to chronic obstruction there is no rigor, and frequently not even a chill, but the symptoms begin very insidiously, and run a very irregular course, extending sometimes over many weeks or months, during which there are intervals of such considerable improvement as to appear like recovery.

As soon as the inflammation has thoroughly set in the general health of the patient is much impaired, and this is shown by weakness, languor, drowsiness, loss of appetite, flatulence, and often by a feeling of extreme flatulent distension of the abdomen, rapid emaciation, pinched features, and a dull, leaden, or sallow complexion.

The temperature in the morning is normal or subnormal, but rises at night to 100°, 101°, or 102° Fahr.; and thus it may continue for days or weeks together; or there may be intervals during which the morning temperature is one or two degrees above normal, and the evening temperature one or two degrees above the morning; or, again, periods may occur during which the evening temperature does not reach above normal, and the morning temperature remains normal or slightly subnormal. As a consequence of the difference in the constitutional states suggested by the temperature, the patient feels better in the morning and also during

the periods of normal night temperature; his skin is cool and he is free from thirst. As the day wears on, and when the intervals of normal evening temperature have passed, languor and drowsiness overtake him, his skin is hot and pungent, and there is great thirst, with marked disinclination for, and even loathing of, food. Sometimes profuse sweats break out all over the body, and occasionally are frequent and severe enough to require a change of linen three or four times in the twenty-four hours. The tongue is sometimes but little altered, being moist and only slightly furred; but in most cases it is dry or coated with a dirty white fur. Nausea is often complained of; sometimes actual vomiting is frequent, but this is not the rule. The bowels may act regularly, or may be constipated or relaxed; usually there is but little disturbance from the habitual state.

Rarely, if ever, is there any tenderness on deep pressure about the kidney, and pain is seldom felt; though in some cases there is muscular aching, described variously as lumbago, rheumatic pains in the limbs, or a feeling of soreness, as of having been "beaten all over with a stick." Generally, however, there is freedom from pain, unless it be caused by the primary disease; and the patient is either in a state of drowsy languor, or when for the time free of fever, he expresses himself as comfortable and doing well.

But little information is to be gleaned from the urine, though it should always be most carefully and repeatedly examined. Too often, especially when the renal inflammation is the result of obstruction, pus, mucus, and even blood derived from the inflamed mucous membrane of the pelvis mask the characters possessed by the urine as secreted. In other cases of obstruction, where no cystitis is present, the urine is of lower specific gravity, and more abundant

in quantity than normal, but this is owing probably more to the chronic pressure changes in the kidney, than to the nephritis. In other cases, again, and more especially where the nephritis is the effect of reflex disturbance uninfluenced by chronic renal changes, there is nothing abnormal either in the character or quantity of the urine.

There is never more than a trace of albumen in the urine as it is secreted, but when cystitis, prostatitis, or urethritis exist, there may be a considerable admixture of pus or blood. Under such circumstances, in order to ascertain the nature of the urine as it is secreted, the bladder and urethra should be well washed out, and the urine which is secreted immediately afterwards should be drawn off through a clean catheter, tied in for a quarter or half an hour; in all probability the urine which flows away will be acid and free of pus and blood.

When the disease is going to terminate favourably, the symptoms just described gradually disappear; the patient feels less drowsy and stronger, his appetite returns, flatulence ceases, the temperature becomes and continues normal, and thus by degrees, and sometimes very quickly, he returns to thorough health. In some cases, however, this apparent recovery is delusive, and after a longer or shorter time all the same symptoms recur; the improvement and subsequent relapse being generally caused by a corresponding improvement in, and aggravation of, the original disease; or, in other cases, the relapse is excited by a fresh instrumental disturbance of the urinary passages. When the nephritis does not terminate favourably, the above symptoms either exist for a long time, while the patient grows weaker and weaker, until at length he dies of pure exhaustion; or, what is more frequent, suppuration of the kidney, to be described in the next section, supervenes, and rapidly carries off

the patient, who becomes first more or less delirious and then comatose. Patients occasionally die who have had all the symptoms of "urinary fever" attended with suppurative pyelo-nephritis; and yet on post-mortem examination the kidneys to the naked eye are merely small, tough, and granular, but on microscopic examination marked interstitial inflammation and foci of commencing suppuration are found. Such a case is related in full on pages 384 to 386.

Diagnosis.—When a patient is suffering from cystitis, whether due to stricture, stone, prostatic enlargement, cancer, or other cause; or when a surgical operation has been performed for stone, bladder tumour, stricture, urinary fistula, urinary abscess, or extravasation, it is often impossible to decide as to what extent the symptoms are due to the primary disease or to superinduced interstitial nephritis. Under any of these conditions, chronic blood poisoning, due to the absorption of decomposing urine or pus, may arise, and excite much the same symptoms as subacute interstitial nephritis; whilst the acute form of the disease, even when no suppuration exists, may possibly be mistaken for pyæmia, septicæmia, typhoid fever, or septic peritonitis.

But when the symptoms above described come on shortly after passing an instrument along the urethra, or after the performance of some surgical operation, there ought to be little doubt of their cause, and active renal inflammation should be diagnosed. In cases of obstruction, interstitial nephritis ought to be suspected when loss of appetite, elevation of evening temperature, hebetude, thirst, dry tongue, flatulence, and nausea, are accompanied and followed by progressive emaciation. If, in addition, there be occasional chills and profuse perspirations, the diagnosis is made more clear; and if with these other symptoms the urine is over-abundant in quantity, of

low specific gravity, and without any, or with but a trace of albumen, it may be looked upon as certain.

A due appreciation of the above symptoms, with a close inquiry into the clinical history of the case, and the antecedent condition of the patient, ought to point to the exclusion of pyæmia, septicæmia, typhoid fever, and septic peritonitis.

Prognosis.—If the kidney is healthy, acute inflammation, whether it be excited by the introduction of a catheter or a surgical operation, will, in all probability, subside after running through a short course extending over a few days, or possibly a week or two.

If the primary cause of disease is removable, and the nephritis stops short of the suppurative form, recovery may be hoped for, and in a large proportion of cases will be realised. If the cause of obstruction cannot be removed, or, after being removed, leaves behind it so severe a condition of bladder or prostate that the urine continues to decompose as soon as it reaches the bladder, suppuration in the kidney will in all probability supervene, and a fatal termination will certainly occur. Death may occur before the disease has thoroughly passed into the suppurative stage. (*See* case on pages 384 to 386.)

In cases in which the onset of the nephritis is associated with prolonged suppression of urine, great danger exists, and a fatal termination should be apprehended. It is said that suppression, if lasting over one day, is almost always fatal (Beck). I have, however, seen recovery in one case after suppression for fifty-two hours, and in others, after suppression for thirty-six and forty-two hours. There are instances of persons after nephrectomy living several days without a particle of sound kidney substance, and without, therefore, secreting one drop of urine. In the *Lancet* of December 20, 1884, a case is reported of total

suppression of urine for nine days followed by recovery. In Vieusseux's case (*see* chapter xi., on absence of both kidneys) it is said there was suppression for seventeen months.

Pathology.—Almost invariably both kidneys are affected. They appear swollen, of a pale yellowish-white colour, and dotted on the surface by gorged stellate veins. The renal capsule is more or less opaque and vascular, and is, as a rule, adherent to the circumrenal tissues. On section, the kidney surface bulges, owing to the amount of intertubular exudation; and it presents a pale or mottled aspect, like the uncut surface of the organ. If there are no pre-existing pressure changes, the renal substance is much softer than normal; if, on the other hand, there have been chronic pressure changes going on, it will be tougher than normal. Sometimes the pyramids are of a deep red colour, and contrast markedly with the pale cortex; at other times they are pale. Sometimes, again, yellowish streaks pass through them, parallel with the tubules. The pelvis of the kidney is sometimes quite normal and the urine within it acid; sometimes the pelvis is deeply congested and ecchymosed, or coated with a layer of false membrane; and again, in other cases it is actively inflamed, and the urine within is alkaline, purulent, and decomposing.

The microscopic characters have been closely studied by Beck, who has pointed out that the anæmic condition of the cortex, as seen after death, is no evidence that during life it was in the same condition; but that as the kidney, owing to the amount of exudation, is tightly compressed within its capsule, the vessels are emptied as soon as the heart ceases to beat. Between the tubules, amongst the vessels of the Malpighian bodies, and round about the Malpighian corpuscles, there is a very abundant, but

not everywhere uniformly large, accumulation of small round cells; these cells are in places so crowded together as to compress the tubules as well as the blood-vessels. The epithelium of the tubules is unchanged, or at most only a little cloudy, granular, and swollen; it is, too, easily detached from its membrana propria. Some of the tubules may have within them fibrinous plugs; and in very acute cases the same kind of small round cells as are exuded between the tubules are seen also within them; when floated onwards with the urine, these cells can be detected in that fluid as pus cells. Though the blood-vessels are usually empty, it is by no means uncommon to find small extravasations of blood into and between the tubules.

Treatment.—In no disease is the old adage, "prevention is better than cure," more true than in these secondary affections of the kidney. Prevention, too, is all the more desirable because our means of cure are uncertain, and for the most part quite inefficient.

As means of prevention, then, it cannot be too forcibly stated:

(1) That the causes of obstruction to the passage of urine should as soon as possible be overcome, and retention, or partial retention, obviated by the catheter. Stricture must be dilated or divided; perinæal abscesses opened; the condition of the prostate should be ascertained, and when found to be enlarged, the patient should at once be taught the use of the catheter; vesical calculi should be crushed or removed by lithotomy, though it must be understood that the rapid method of lithotrity has now done away with the need of replacing lithotrity by the more dangerous operation of lithotomy in cases in which renal disease complicates vesical calculus.

(2) All instrumentation should be as gentle and as limited as the requirements of the particular case

will allow, so as to avoid the risk of reflex irritation of the kidney.

(3) Decomposition of the urine within the bladder should be prevented or checked by the evening and morning irrigation of the bladder with some antiseptic wash. A solution of salicylate of soda (five grains to the ℥j), of quinine (one grain to the ℥j), of acetate of lead (one grain to ℥iv), of borax (five grains to ℥j), of warm water coloured pink with Condy's fluid, or containing a trace of carbolic acid, or of thymol and glycerine (in the proportion of one part of thymol in seven of glycerine), may be used for this purpose. The fluid should be introduced through as large a catheter as can be comfortably passed, and the catheter should have two large well-formed eyes. Not more than ℥iij to ℥iv of the solution should be thrown in at a time; then this should be allowed to run out, and the same process should be repeated four or five times, or more, at a sitting.

In any case in which subacute or acute renal mischief is anticipated, and certainly from the outset of its existence, the patient must be confined to his room, and, as a rule, absolutely to his bed; his skin should be kept thoroughly warm, and free from the risk of chills or the effects of changes of temperature; all exertion should be avoided from the first; the bowels should be acted upon daily by enemata; hot baths or wet packing or vapour baths should be employed if they can be borne; hot dry bran or flannels should be applied to the loins, and dry or moist cupping in the same region should be resorted to, especially if there is pain or tenderness about the kidneys. The food should be of a bland, nutritious, and easily digested character; stimulants, as a rule, should not be allowed, or, if allowed at all, only in small quantity, and in as pure a form as possible; but if patients, who have always drunk freely, are in a very

weak condition, and cannot take sufficient food, then a moderate measured quantity of some pure wine or spirit will be needful.

No medicines are of any special use; still, I have seen marked benefit in cases uncomplicated by pre-existing chronic renal disease, but attended with suppression of urine, from the hypodermic injection of $\frac{1}{8}$th to $\frac{1}{4}$th grain of morphia with $\frac{1}{120}$th to $\frac{1}{60}$th grain of atropine. Tannic acid in two-grain doses, given every three or four hours, has been recommended especially in cases of abundant mucus secretion in the urinary passages (Ebstein). Quinine in grain and a half or two-grain doses, with citrate of potash (twenty grains) and mucilage ʒj, together with a little opium (five to ten min.) is often beneficial. If the temperature is rising, a dose of five to ten grains of quinine with lemon-juice ʒj, and vin. opii ʒss, is sometimes of much value.

Opium by some surgeons is considered the most useful of drugs, because by increasing the action of the skin it tends to relieve the congestion of the kidneys; but it is a remedy which ought to be given with great caution, for it must be remembered that symptoms much resembling, sometimes actually expressive of uræmia, occur in acute interstitial nephritis.

When acute or subacute interstitial nephritis has been preceded by intrarenal tension and chronic interstitial inflammation, the amount of urine secreted is very large indeed; and under these circumstances I have seen good follow the administration of the liquid extract of ergot given in ʒss doses every three or four hours for thirty-six or forty-eight hours.

Surgical operations, and more especially operations upon the urinary organs, if it is possible to postpone them, should never be undertaken during the existence of acute or subacute interstitial nephritis, or even of any of the forms of "congestive" urinary fever.

CHAPTER XXV.

SUPPURATIVE NEPHRITIS, PYELITIS, AND PYELO-NEPHRITIS.

One of the most frequent of the secondary affections of the kidney (secondary, that is, to obstruction to the outflow of urine; to reflex irritation; or to decomposition of urine in the bladder) is suppuration in the pelvis, or in the substance of the kidney, or in both.

In by far the greater number of such cases, chronic dilatation of the pelvis and calyces precedes suppuration of these parts, and later on numerous small scattered abscesses occur throughout the renal substance. It is to this general affection of pelvis and substance of the kidney from obstruction in, or disease of, the lower urinary passages that the term suppurative pyelo-nephritis has been given. It is to this condition that the term surgical kidney has also, but very inaptly, been applied. With regard to this opprobrious epithet, Sir Henry Thompson has written, "Why 'surgical' kidney indeed? Certainly in one sense only, namely, that it is for want of surgical aid that the organs have come to the state in which they are. If that aid were rendered early in the history, whether it be stricture or stone, no such condition would ever arise." This refutation is no less incisive than true; yet it must be admitted, and that, too, in further refutation of the term "surgical kidney," that the disease will sometimes arise from causes beyond the control of the surgeon, and even in spite of the use of the catheter and irrigation of the bladder.

For example, in cancer and other growths of and invading the bladder, and in cases of obstruction to the ureter beyond the reach of the surgeon, these consecutive changes in the kidney are induced.

Suppurative nephritis, or, in other words, "acute interstitial nephritis, with scattered points of suppuration" (Beck), occasionally occurs alone, without any affection of the ureter and pelvis of the kidney; this, however, is not the common case. Usually acute pyelitis and suppurative nephritis exist simultaneously; but if suppurative nephritis happens to be uncomplicated by pyelitis, the nephritis is prone to be overlooked; because then the urine contained in the pelvis of the kidney, and passed off through a catheter immediately after washing out the bladder, is acid and without the odour of decomposition. Nevertheless the temperature and other constitutional symptoms ought to correct the fallacy. Occasionally, by coalescence of several points of suppuration, suppurative nephritis results in an abscess of large size, which may burst into the surrounding tissue, or into the pelvis of the kidney; but these cases have been previously considered under the head of renal abscess.

Causes.—The various morbid conditions which retard or prevent the outflow of urine, and which, therefore, originate the suppurative diseases of the kidney, are: stricture of the urethra; enlargement of the prostate; vesical calculus especially when of large size; atony of the bladder; palsy of the bladder following spinal disease or spinal injury; congenital phymosis; foreign bodies, such as calculi, cancer, tubercle, parasites, and blood coagula, in the ureter, renal pelvis, or calyces; and in the female various affections of the sexual organs, *e.g.* pregnancy, perimetritis, ovarian disease, malignant disease, and inflammatory

exudation about the pelvic organs, which by pressure or encroachment upon the bladder or lower end of the ureters cause retention of urine.

As an effect of the decomposition of urine, it occurs in neglected cystitis from any cause, even when of a non-obstructive character.

Pyelitis and pyelo-nephritis, like cystitis, are excited by many causes other than those which obstruct the outflow of urine. Thus it is a frequent complication in typhus, typhoid, the exanthemata, diphtheria, carbuncle, pyæmia, scurvy, cholera, acute and chronic Bright's disease, and diabetes; in these general diseases, however, it often runs an insidious course, and is induced by the alteration in the characters of the urine secreted under the influence of a severe constitutional disorder; or it may be due to the changes in the urine which occur in the bladder under the combined effects of palsy and catheterism. I have known acute suppurative nephritis in a typhoid fever patient (a young woman) who had been daily catheterised for about twenty-five days before death.

Pyelitis and even inflammation of the renal substance are also excited by large doses of turpentine, cantharides, copaiba, cubebs, and other diuretic irritants; in these cases, however, the chief seat of disturbance is the bladder, and the renal affection is transient and comparatively unimportant.

I have the notes of one case in which the renal pelves of a man, aged twenty-nine years, who died of poisoning by oxalic acid, were most acutely inflamed, and the seat of numerous ecchymoses.

From the records of the Middlesex Hospital I find thirty-nine cases of pyelo-nephritis in the ten years ending 1883.

In twenty-six of them there was suppurative nephritis, with more or less severe pyelitis; but without dilatation of the cavity of the kidney, and

without perinephric abscess. In twelve cases pyonephrosis was associated with the suppuration in the renal substance. In one case perinephric suppuration resulted from the bursting of a small abscess through the capsule of the kidney. This occurred in a man, aged 50, who had locomotor ataxy, prostatic abscess, and cystitis. Both kidneys had small points of suppuration scattered in them, and the pelvis of each kidney was inflamed. Around the left kidney in the perinephric fat there was a large abscess.

Of the twenty-six cases of pyelo-nephritis seven were unassociated with disease of or involving the lower urinary organs or ureters. Four out of the seven were unquestionably pyæmic, and the other three were almost certainly metastatic abscesses.

Septicæmia, chronic phthisis, enteric fever, ulcerative endocarditis, periostitis, pericarditis, and mammary cancer with recurrence in the intestines, were the causes of death in these seven cases.

In the other nineteen cases there was disease of or involving the lower urinary organs, the nature of which was as follows:

Cancer of the rectum in	2
Cancer of uterus	1
Enlarged prostate and cystitis	3
Abscess in prostate and chronic Bright's disease	1
Rupture of urethra with extravasation of urine	3
Stricture of urethra and cystitis	1
Cystitis from various causes, including three of spinal cord affections	8

In two of this last group of eight cases it is possible that the nature of the disease was pyæmic, for the cause of the cystitis is not mentioned, and one of the patients died with epithelioma of the lower jaw, and the other with carbuncle in the neck.

The exciting causes in the twelve cases of pyelo-nephritis associated with pyo-nephrosis, have been stated in the chapter on pyo-nephrosis.

Pyelo-nephritis occurs at all ages, but is more common in adult males than in young males or females; this is owing to the fact that the principal exciting causes, especially stricture of the urethra, renal calculi, and prostatic disease, are so common in adult males.

Symptoms.—When a patient who is the subject of retention or decomposition of urine develops high fever, headache, somnolence, torpor, nausea, a dry brown or a dry crusted and fissured tongue, and a face at once anxious and sallow, and, in addition, emaciates rapidly, there can be no room for doubting that pyelo-nephritis is present and will in all probability be the death of its victim. In such cases the affection of the kidney and its pelvis is a sequel of a chronic disease such as stricture, enlarged prostate, etc.; or is a complication of some more recent affection, such as acute traumatic spinal disease, for which very likely, though by no means necessarily, catheterism has been repeatedly employed. But in certain rare cases the same symptoms, due to the same changes in the kidney, are developed immediately after an operation on the bladder or urethra as the result of reflex irritation of the kidney, and are then regarded as a form of urethral fever, under which heading they will be again referred to.

The symptoms of secondary or consecutive pyelo-nephritis are in fact the same, though in an extreme form, as have been already described under acute and subacute interstitial nephritis. The only difference in the symptoms between acute interstitial nephritis without suppuration and acute interstitial nephritis with suppuration, is in the higher fever, the more marked disturbance of the nervous system, and the

greater rapidity with which the case proceeds towards a fatal termination, when the disease assumes the suppurative character

Sometimes, but by no means always, it commences with a rigor; in other cases there is no rigor throughout the course of the disease, or the first rigor is experienced only a day or two before death. The temperature, however, always rises at, or soon after, the outset, and in many cases continues uninterruptedly to reach a high point in the evening, up to a short time before death; sometimes the evening temperature reaches 105° or 106°. In some cases it intermits, so that between the beginning and ending of the disease there are three or four or more periods of four or five days each, during which the temperature is high; and between these periods intervals of four or five days, during each of which the temperature is much more nearly if not quite normal.

As an example of the first, or continued high fever, I give the subjoined temperature chart (Fig. 25), of a man, aged sixty-three, who had dilated and sacculated kidneys caused by very extensive papillomata of the bladder. I performed external median urethrotomy for the purpose of exploring, and if possible removing, the growth. The operation was done twenty days before the patient's death. At the post-mortem examination both kidneys were found to be in a state of suppurative pyelo-nephritis, the right kidney being the most advanced in disease. The ureters and kidneys were much dilated. A glance at the chart shows, that though the morning temperature fell occasionally to normal, or even a little below, yet it was frequently above, and sometimes more than two degrees above the normal; and that the evening temperature was always high, reaching on one or two occasions nearly 104° Fahr. It will be observed that the temperature indicative of these renal

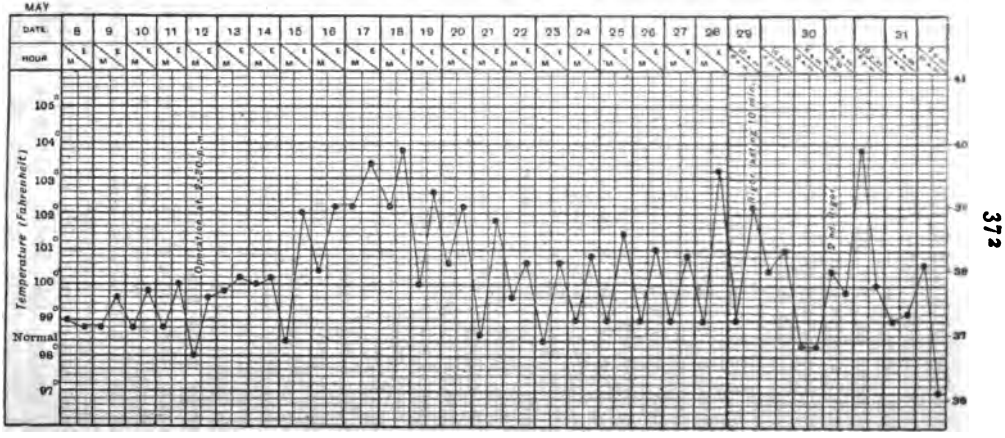

Fig. 25.—Continued Fever, in case of Suppurative Pyelo-nephritis. Temperature Chart of G. L., æt. 63 years.

changes had commenced in a mild form before the operation. *

In this case the first rigor occurred on the *second* day before death, and a second rigor followed on the day before death. On the night before death the temperature was 103·8° and all through the morning of the day of death it was above 99°; at 2 p.m., however, it fell suddenly from 100·6° to 97°, and at 5 p.m. the patient died, having been unconscious for an hour.

As an example of the **intermittent fever** I may refer to the case of a distinguished member of the profession who succumbed after an illness of six weeks to suppurating interstitial nephritis engrafted upon dilated kidneys, and chronic interstitial nephritis. For four or five years this gentleman had entirely neglected the warning symptoms of retention of urine from enlargement of the prostate, notwithstanding that his condition had necessitated the use of an urinal when travelling or in society.

At length an attack of severe flatulent dyspepsia, combined with obstinate constipation, led to the discovery on the part of his physicians of a tumour to the left of the hypogastrium, and for this I was asked to see him. At this time very large quantities of thin limpid urine, eighty to ninety-three ounces a day, were being excreted, and great thirst was felt. The tumour proved to be the bladder filled with over two pints and a quarter of urine, of a thin light colour and low specific gravity. Now began the regular use of the catheter on September 9th, and large quantities of urine continued to be withdrawn daily. On September 15th the urine became bloody from unsuccessful attempts on the part of the patient to pass the catheter on himself; afterwards he had

* An instrument had only been passed once before the operation, and that by the skilful hand of Sir Henry Thompson.

a slight rigor, the only one throughout the illness. On September 17th the urine was clear again. On September 25th a little mucus and pus appeared for the first time in the limpid urine; the urine was acid, sp. gr. 1015, contained no albumen, and was passed by the catheter in large quantities. On this day and the following the temperature rose at night above 100°, and was slightly above normal in the morning. From the 27th September to October 2nd it was as follows:

	Morning.	Evening
Sept. 27	99·4°	102°
„ 28	100·2	103·4
„ 29	101·4	103·4
„ 30	101·4	103
Oct. 1	101	102
„ 2	99·2	100·2
„ 3	98·2	

From October 3rd to October 10th the temperature remained normal, but from the 10th to the 16th inclusive it ran:

	Morning.	Evening.
Oct. 10	100°	103°
„ 11	102	104
„ 12	102	104
„ 13	102	104
„ 14	101	103
„ 15	100	102
„ 16	98·4	

For five days it continued normal, or almost so, but on the 20th October it rose in the evening 99·8°, and on the 21st (morning) 101°, (evening) 103°, when it again fell to normal on the morning of the 22nd October, to rise again in the evening to 101°. After this date the temperature presented similar marked variations; the intellect, which through life had been of a bright and active order, rapidly waned, the skin became cold and clammy on October 31st, and

he died on November 1st, after being in a state of coma for two hours. At the post-mortem there were well-marked signs of pyelo-nephritis, and the ureters and pelves were dilated. A large sacculus of the bladder, and an enlargement of the middle lobe of the prostate were found.

It was a notable feature in this case, that with the subsidence of the feverish attacks not only did the general condition seem to improve, but the quantity of urine diminished, so that it fell, for example, from the 3rd to 10th of October, to between forty-two and sixty ounces per diem. During as well as before the first attack of fever, from eighty to ninety, and even ninety-three (Sept. 27th) ounces of urine were voided in twenty-four hours; but afterwards, though the quantity was larger during the febrile than during the non-febrile periods, it never exceeded seventy-four ounces in twenty-four hours, and sixty to sixty-five was about the average quantity. After the third febrile attack it varied from forty-four to fifty ounces, but never exceeded fifty-five ounces. The amount of urea, though from the first somewhat deficient, diminished still more as the case progressed, being sometimes from seven to ten grammes less than the normal. The urine became, during the last three weeks, offensive and largely charged with pus and bacteria. Yet at the post-mortem examination the ureters were not inflamed, but the sacculus in the bladder, in spite of daily irrigation, had served as a reservoir for the decomposing urine. The morbid changes in this case will be again referred to.

In some cases profuse sweating occurs at intervals; in a general way the skin keeps moist, and is very often bathed in a clammy perspiration, which towards the end of the disease becomes cold. The tongue is dry, cracked, parched, and brown.

Aphthæ often affect the mouth; appetite and power of digestion are lost during the fever; the bowels are frequently costive and distended with flatus, or diarrhœa from time to time may occur; nausea, but not vomiting, is sometimes troublesome; and emaciation is very pronounced and rapid. There is little or no pain about the loins, but I have frequently observed that severe spasms, referred to the neck of the bladder, are complained of as soon as any moderate quantity of urine accumulates in the bladder. After the discomfort caused by the parched condition of the mouth and the disturbed state of the digestive organs, these spasms are the chief cause of distress. The mental aspect of the patient is for the most part unruffled; he is perhaps silently anxious and apprehensive about himself, but there is no excitement or active delirium. On the contrary, he at first reads, or thinks he reads, a great deal, but he doses much over his book or paper; or he lies dreamily, as if under the effect of morphia; but as the disease advances there is more actual somnolence and torpor, he rouses himself with effort, starts during his sleep, and perhaps even mutters incoherently. Though generally conscious or semiconscious to near the last, coma, even profound coma, often anticipates death by an hour or two. The pupils are but little interfered with during the course of the case, unless they are contracted from the effect of opium or morphia.

The character of the urine varies in different cases; if the state of the bladder is bad the urine is of course largely mixed with mucus, pus, phosphates, and perhaps blood; but in other cases in which the pelvis of the kidney suppurates quickly, the urine is purulent and acid at first, and afterwards purulent, phosphatic, and alkaline, whilst the bladder for a time remains in a fairly healthy condition. This is

a proof, if any were needed, that pyelo-nephritis does not require for its production an unhealthy state of the bladder, nor the ammoniacal decomposition of urine within the bladder, and also that these conditions of the bladder may themselves result secondarily from the entrance into the bladder of alkaline and purulent urine from the kidneys. In many cases the amount of urine is increased and the quantity of urea excreted is decreased, owing to the chronic changes which have taken place in the kidney. These changes may be the result of chronic Bright's disease, but more often of increased urinary pressure from long-standing obstruction to the outflow of urine. If the fever is of the intermittent character the urine is generally more abundant during the periods of fever than between them. Usually it continues to be excreted in considerable quantity up to the end, but the quantity is often comparatively decreased towards the close of the disease. This is explained, I think, thus: Each accession of fever represents the outbreak of the acute inflammatory process in a fresh area of the kidney. An increased quantity of blood is thus brought to the kidneys, from which the portions of the organs not yet affected extract an increased quantity of water; after the destruction of this newly attacked area the increased activity of the circulation in the kidneys subsides for a time. Afterwards, there is so much less excretory substance left for future use; hence the diminution of urine during the intervals of immunity from the fever, and also towards the end of the patient's life. The presence of albumen varies with the pus and blood; generally there is no free albumen. Hyaline, granular, and even pus casts may be found, though but rarely; for this, if for no other reason, that long before they are shed the urine has generally become too foul to permit of their discovery. When the bladder is unaffected epithelial cells from the

renal pelvis may be discovered in the purulent urine, more especially if the urine maintains an acid reaction.

Diagnosis.—When purulent urine of acid reaction, and containing renal epithelium, is voided by one who is suffering from pains in the region of the kidney extending along the ureters to the bladder, we may safely diagnose the existence of pyelitis. If, on the other hand, there is some disease of the bladder so that the renal epithelium, if any be voided, is masked by the changes which take place in the urine after it reaches the bladder; and if, also, as is frequently the case, there are no pains in the lumbar regions, then pyelitis is likely to be overlooked.

Pyelo-nephritis, when secondary to disease of the bladder, is too often unrecognised until discovered at the post-mortem examination. But this should not be so; because in cases of disease of the lower urinary organs, especially when associated with partial or complete retention of urine, there are two sets of symptoms which ought at once to lead the surgeon to a correct diagnosis.

These two sets of symptoms are fever, and the typhoid state into which the patient quickly passes. If, therefore, a person suffering from stricture of the urethra, prostatic enlargement, tumour of the bladder, cancer of the uterus, or other disease involving the lower urinary tract, develops a high temperature at night (*i.e.* from something over 100° to 105° or even 106°), and becomes drowsy, prostrated, and rapidly loses flesh, has a dry coated tongue, a quick, weak pulse, a tendency to nausea, and from time to time profuse perspirations, and, it may be, an occasional chill, the diagnosis of pyelo-nephritis admits of no doubt.

From whatever cause arising, pyelo-nephritis, or interstitial suppurative nephritis, is to be distinguished

from **acute Bright's disease** by the absence of convulsions, of œdema, and of the harsh and dry skin of Bright's disease. In pyelo-nephritis, if coma occurs at all, it is only for a few hours at most before death; and the urine, instead of being scanty and of a reddish-brown colour, as in Bright's disease, is abundant in quantity, purulent in character, and but slightly, if at all, tinged with blood.

Pyæmia may generally be distinguished from pyelo-nephritis by the secondary abscesses, and the tender purulent swelling of the joints, as well as by the extreme variations in the high temperature which mark the rigors and the succeeding sweats so characteristic of pyæmia. In pyelo-nephritis there may be no rigor throughout; in pyæmia some days may pass without any rigor at all, and then two or three attacks may occur in the same day. In pyelo-nephritis, when occasional profuse sweating occurs, it is not as a sequence of a rigor. In pyæmia the sweating follows the rigors. The rigors of pyæmia are accompanied by a rise of temperature, reaching often as high as 105° to 107°; the succeeding sweats by a sudden fall to normal or subnormal; but very shortly after this fall the temperature rises again to, and continues at, the high febrile level of the disease. Both in subacute and acute interstitial nephritis I have known muscular pains about the thighs, hips, and wrists complained of, and pyæmia has in consequence been suspected; but in renal disease there is no tenderness, redness, or swelling of the painful parts, and the pain is relieved by gentle friction and soon passes off altogether. In pyelo-nephritis there is not the sweet mawkish odour of the breath, the offensive diarrhœa, nor the **jaundiced** tint of the skin, which often attracts attention in pyæmia.

From **acute septicæmia** pyelo-nephritis is to be

distinguished by its less rapid course and by the absence of that restless anxiety, delirium, and tossing of the extremities which accompany the prostration and rapid sinking in septicæmia. There are never, in suppurative nephritis, the purpuric stains in the skin, nor the ecchymosis of internal organs which result from the blood changes of acute septicæmia.

From the **less acute forms of septicæmia,** those, namely, which last from two to three weeks, and in which no secondary abscesses or purulent depots are formed, it is difficult to diagnose suppurative inflammation of the kidney. Some of the fatal cases of so-called urinary fever of a typhoid form, in which the autopsy reveals no renal disease adequate to explain death, are really cases of septicæmia. Others are doubtless due to chronic cystitis, or a combination of chronic cystitis and septicæmia. **Chronic cystitis,** as Brodie pointed out, excites a low febrile disturbance of the system, attended with great debility. This low form of continued fever may terminate fatally, especially when the mucous membrane of the bladder is eroded, ulcerated, or sloughing. Indeed, the real cause of death in pyelo-nephritis is perhaps less due to the distinctive changes in the kidney than to the inoculation of the whole system by septic matter absorbed from the damaged kidney or the offensive urine (Beck).

From **typhoid fever** the history and course of the disease, and the absence of typhoid stools, will usually sufficiently serve to distinguish pyelo-nephritis. The temperature chart, and the typhoid character of the general symptoms in the latter disease are, however, like to those of the later period of typhoid, the temperature rising at night to 101° to 104°, and falling in the morning to 99° or lower. Moreover, pyelitis and even pyelo-nephritis are occasional complications of typhoid. I have known one of our most

distinguished physicians withhold for a day or two his diagnosis in a case of pyelo-nephritis secondary to prostatic disease, feeling uncertain as to whether it was not a case of typhoid fever.

No difficulty in diagnosis ought to arise between **ague** and secondary suppuration of the kidney. It is asserted, and is probably true, that rigors after catheterism and operations on the urinary organs are of frequent occurrence in persons who have had ague or lived in ague districts. But the general and progressive symptoms above described ought to distinguish pyelo-nephritis or suppurative interstitial nephritis from ague.

From **uræmia** the diagnosis is much more difficult. It must be remembered that in some of the fatal cases of urinary fever there is complete suppression of urine for some hours or some few days before death, so that the mode of death comes to be by way of uræmia. Uræmia is but a name for a group of symptoms, and these symptoms may sometimes, though they by no means always, occur in the fever which follows catheterism and operations on the urinary organs.

Septicæmia plays a by no means insignificant part in causing death in certain cases of urinary trouble. In old men with enlarged prostates, in long-standing stricture cases, in typhoid and other continued febrile states, and in disease and injury of the spine, and even in simple atony of the bladder, decomposition of the urine occurs within the bladder, and the mucous membrane of the bladder becomes inflamed and eroded. So, also, in cases of pyelitis from calculus or tubercle of the kidney, the mucous membrane becomes diseased, and fermentative changes occur in the urine. Thus septic material may be absorbed from the bladder or renal pelvis, and give rise to constitutional infection quite independently of instrumental irritation. Again, in suppurative nephritis and pyelo-nephritis, septic

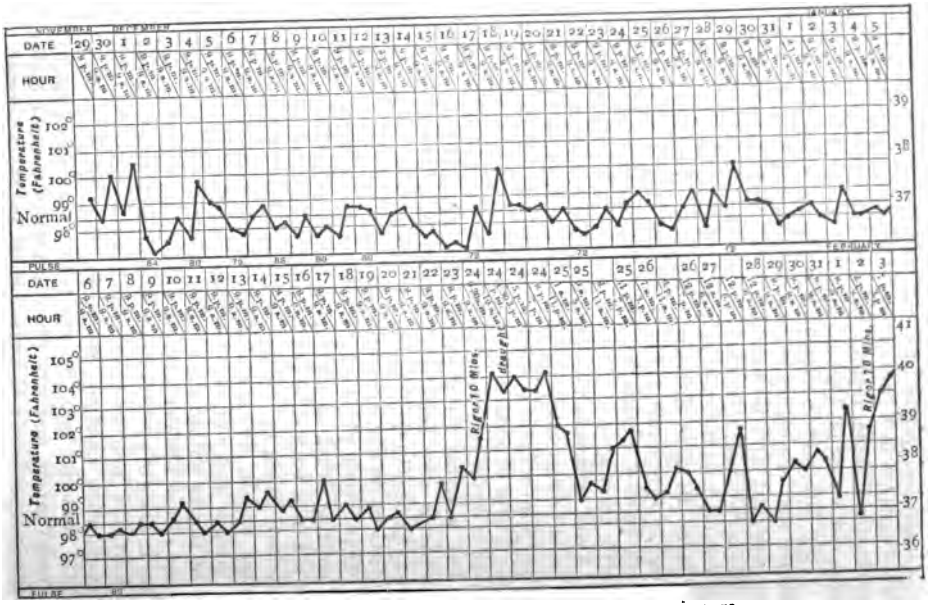

Fig. 26.—Interstitial Nephritis. Temperature Chart of W. F., æt 53.

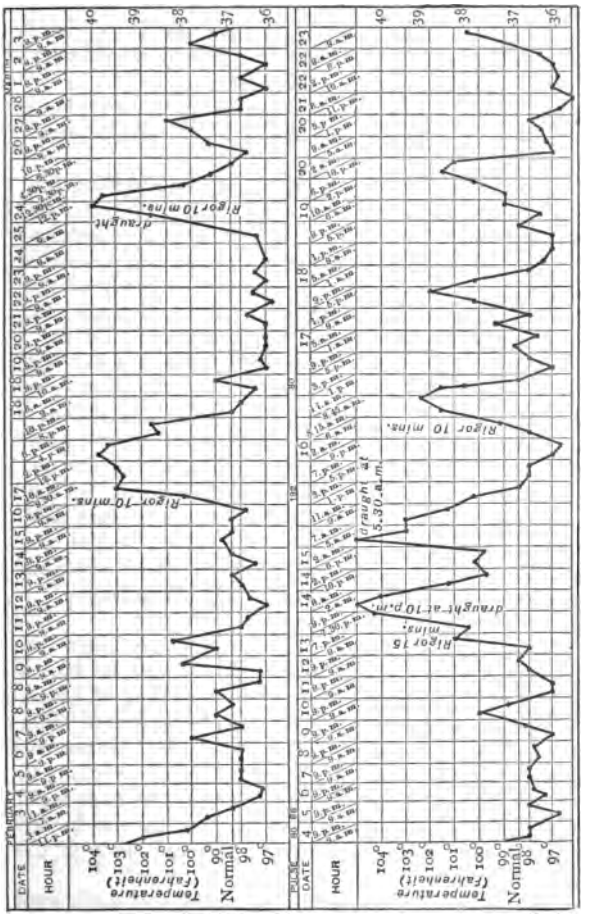

Fig 27.—Interstitial Nephritis. Continuation of Temperature Chart of W. F., æt. 53.

material may be absorbed from the purulent tracts of the kidney or from the putrid urine within the renal pelvis, and death may be caused partly by the damage to the kidney and partly by septicæmia.

The symptoms of all these cases are of a low typhoid character, very like those which have been detailed above.

In some cases in which the symptoms during life point most strongly to suppurative interstitial nephritis, the kidneys are found free of suppuration, sacculation, or dilatation; and nothing presents itself to the naked eye, either within or without the kidneys, adequate to account for the symptoms and death, yet the kidneys are really the cause of death.

Such a case is the following, in which I did not doubt we should find well-marked scattered foci, or even much larger suppurating areas in each kidney; but at the post-mortem examination these organs were apparently only small and toughened. There was not the slightest trace of suppuration evident to the naked eye; yet under the microscope there were seen collections of nuclei around some capillary vessels like the early stage of "miliary abscesses." As it explains some cases of "catheter fever," I give it at length.

Wm. F., aged 53, came under my care on November 29th, 1884. Four years before, he had a perineal abscess, followed by extravasation of urine. This was incised, but no catheter could be passed then, nor had one ever been passed since. He cannot remember having had any urinary trouble previous to the perineal abscess. During four years he has passed nearly all his urine through numerous fistulæ in the scrotum and perinæum, and scarcely any through the penis.

On admission, the penis, scrotum, and perinæum were swollen and indurated, and channelled by the

numerous fistulæ through which the urine passed. Around the fistulous orifices and at the anus, as well as in other places on the scrotum, there were several condylomatous outgrowths. No catheter could be introduced. He was in constant pain, and had kept his bed almost entirely since he had been in this state.

On December 2nd I performed perineal section, and for two weeks drained his bladder to keep the fistulæ free of urine; then I passed a full-sized catheter through the whole length of the urethra. This was retained in the bladder for a day or two, and was subsequently used by the patient himself each time he wanted to pass water. The urethrotomy wound was allowed to close. Thus the fistulæ were given a fair chance to heal, but though they decidedly improved they did not close. The patient, however, derived great benefit and comfort from the operation.

Towards the end of January (24th) he had a rigor followed by a temperature of 104°, but the next day the temperature went down to 99°.

From this time it was seldom, if ever, normal for two days together; and at intervals (at first of about seven days) rigors and very high temperature recurred. (*See* Figs. 26 and 27.)

Subsequently these attacks were more frequent; the urine became offensive and purulent in spite of antiseptic irrigation of the bladder; he had periods of sickness, loss of appetite, drowsiness, and feeling of great prostration, and died on March the 24th.

At the post-mortem examination the penis, scrotum, and perinæum were puckered and scarred, and presented several fistulæ. On section of the scrotum a dense whitish fibrous tissue traversed by irregular fistulous tracts was seen.

Most of these fistulæ communicated with the

urethra in the vicinity of the bulb, but one opened into the middle of the spongy portion.

There was slight narrowing of the urethra at the external meatus; then followed about two inches of moderately healthy but rather thickened urethra. All the rest of the urethra as far as the prostate was thickened and quasi-cartilaginous.

In the floor of the urethra, at the membranous part, was the scar of the urethrotomy wound.

The bladder walls were greatly thickened and sacculated; the mucous membrane was of a deep purplish colour. The viscus contained about half a pint of stinking, purulent urine.

The ureters were normal.

Kidneys.—Small. The surrounding fatty tissue adherent to them. Right, 3¾ oz., left, 4oz.; capsules adherent; cortex of each thinned, tough, granular. Portions of each kidney were handed to Dr. Goodhart for microscopic examination, and he reported as follows: "The kidneys are very bad ones, the sections are studded throughout with patches of thickly nucleated fibrous tissue, and the connective tissue and vessels are decidedly thick. In one part I find a collection of nuclei around some capillary vessels, such as is denominated miliary abscess by some. I should suppose the disease to be one of some standing, yet actively in progress. The appearances do not differ from those of many a case of granular kidney."

Prognosis.—The prognosis of pyelo-nephritis or suppurative interstitial nephritis is very unfavourable, and most patients thus afflicted die within three or four weeks.

In some very acute cases death occurs in three or four days; the average duration is, however, from two to three weeks.

Occasionally, when the cause of the disease can

be removed, and the state of the bladder improved by irrigation, the patient recovers. It is not unfrequent to find in the bodies of persons with other evidences of former obstruction in the urinary passages, shrunken irregular kidneys with cicatrices on the surface and in the capsules. Probably in some instances, though not necessarily in all, these cicatrices indicate the healing long ago of small abscesses ; but the same appearances are more probably left by severe inflammatory changes in the kidney short of actual suppuration.

If the fever be high and of the intermittent character, and is accompanied by marked depression, loss of appetite, flatulence, and constipation; and if each attack of fever leaves the patient permanently weaker bodily and mentally, the prognosis is bad, and the patient will die within a few weeks.

If the fever be high and continuous, the downward course is more uninterrupted and the fatal end will come even more quickly.

If the fever, whether intermittent or continued, be but moderate, and the strength of the patient is not rapidly worn away, a favourable termination may follow on the removal of the cause of obstruction.

Pathology.—Suppurative nephritis is the most common, but not the only, fatal form of kidney disease consecutive to disease lower down in the urinary passages. Acute interstitial nephritis without suppuration sometimes ends fatally. I have just related such a case. Nor is suppurative nephritis invariably associated with suppuration in the pelvis of the kidney, *i.e.* with pyelitis; but so generally do the two conditions co-exist that suppurative nephritis and pyelo-nephritis, as ordinarily used, are well-nigh equivalent expressions. In the chapter on pyo nephrosis, I have mentioned that in a number of cases collected from post-mortem records, pyelo-nephritis and pyo-nephrosis were found affecting the same kidneys.

When the seat of the primary disease is at or in front of the bladder, both kidneys are, as a rule, affected, though one is often more affected than the other. If the primary disease be in the ureter or pelvis of one kidney, that organ alone will be affected. Beck states that he has seen one case in which both kidneys were equally dotted with minute points of suppuration, but in one the pelvis was free from inflammation and the urine therein was acid, whereas in the other the pelvis was suppurating and contained decomposing urine. I have also observed the same fact.

The morbid appearances as commonly met with in this disease cannot be better described than in Dr. Coupland's account of the post-mortem examination of the second case which I have given on page 373.

"The right kidney was enlarged and firmly embedded in a quantity of perinephral fat that could not be completely removed from the capsule. The capsule in turn adhered to the renal substance, and the substance, being unduly soft, was readily lacerated in several places in the attempt to strip off the capsule. Although softened everywhere, there were parts of the renal cortex which were almost pulpy in consistence; these parts had a yellower and paler appearance than the rest of the surface, and were obviously in a state bordering on suppuration. On section through these areas the opaque yellowish character was seen to involve the whole thickness of the cortex and even to extend into the pyramids. The cut surface of the bisected organ presented a mottled appearance owing to the presence of these paler areas contrasting with the deeply-congested (almost black) colour of the basal portions of the pyramids. Elsewhere the cortex had a confused character, and although not obviously increased in thickness was plainly the seat of a diffuse interstitial

inflammation combined with intense vascular engorgement. The pelvis and calyces were dilated, but not extremely so, the apices of the pyramids not being flattened. The lining membrane of the pelvis was striated by arborescent vessels, and marked in places by ecchymoses.

"The left kidney was smaller than the right. Similar adhesions existed between the perinephral fat and the kidney capsule. The surface of the kidney was uneven, and firmly granular, but more uniformly reddened than that of the right kidney. On section, the organ had the same general softened characters, but not to such an extreme degree as the right, whilst the cortical layer was more markedly wasted. The pelvis was slightly dilated, and its lining membrane intensely inflamed, being thickly studded with bright red hæmorrhagic points, as well as covered with minutely injected vessels. The pelvis of each kidney contained purulent and decomposing urine. The ureters, although dilated, had thick walls, and their lining membrane was smooth and natural.

"Thus, there was evidence of chronic interstitial nephritis with dilatation, to which were superadded recent diffuse acute interstitial inflammation and pyelitis in both organs, combined in the right kidney with foci of suppuration."

The accompanying figures of Dr. Coupland's drawings of this case show what may be regarded as typical microscopic changes (acute as well as chronic) in pyelo-nephritis. These are: marked increase of intertubular stroma, with abundant infiltration of leucocytes in the connective tissue, both of the medulla and cortex; the swollen opaque condition of the epithelium, especially in the cortical portion, where the cells were apparently necrotic; and atrophy of some of the Malpighian tufts, with sclerosis, and thickening of their capsules. These figures (Figs. 28 to 32) show well

the several changes of acute inflammation, as well as the changes in the Malpighian tufts which had been wrought by the antecedent chronic interstitial nephritis.

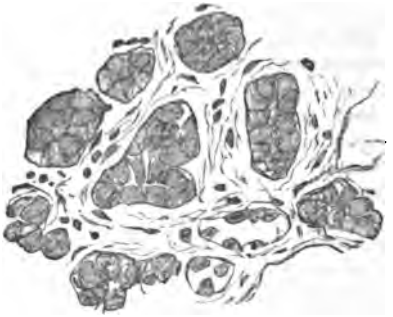

Fig. 28.—Swelling of Renal Epithelium; Nuclei obscured and Protoplasm opaque (probably necrotic). Intertubular tissue in excess. (Cortex × 250.)

To pass from the narration of a case to a general description, it may be said that the suppurating foci vary in size from a pin's head upwards; and on section pale yellow streaks, extending from the cortex into the pyramids, are to be seen. They are surrounded by a deep red zone; and between the areas of suppuration there may be, both in cortex and medulla, intervening tracts of renal tissue scarcely, or not at all, involved in the acute inflammatory changes. The kidney in all cases is deeply congested, more or less, throughout, and is soft and swollen, and often much enlarged.

Fig. 29. — Degenerated Malpighian Body (hyaline fibroid change). (Cortex × 250.)

On removing the capsule the

softened renal substance readily tears away, and many of the little abscesses are opened. The capsule is adherent to the perinephric tissue, and this tissue is often swollen and œdematous. The pelvis of the kidney is inflamed, its mucous membrane being of a deep purple colour, spotted here and there with ecchymoses, or, it may be, ulcerated in patches. Sometimes a gritty deposit of amorphous phosphates coats the surface of the pelvis and calyces, as well as the papillæ of the pyramids.

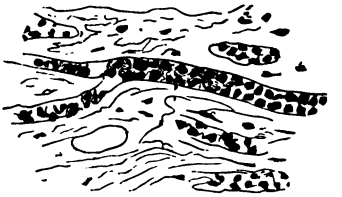

Fig. 30.—Nuclear Proliferation of Epithelia. Excess of interstitial tissue, imperfectly fibrous. (Medulla × 250.)

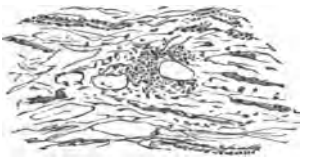

Fig. 31.—Cell Infiltration (inflammatory) of Intertubular Tissue. (Medulla × 250.)

Sometimes even large abscesses are formed, affecting both pyramidal and cortical areas. Occasionally such an abscess may give rise to perinephric abscess, either by bursting through the capsule or otherwise. The ureter is often in the same state as the pelvis of the kidney, but not invariably so; for just as suppurative nephritis occurs without pyelitis, so suppurative pyelo-nephritis occurs without the ureter sharing in the inflammation.

Fig. 32.—Cell Infiltration of Intertubular Tissue, and Destruction of Tubules. (Cortex × 250.)

The purulent tracts in the medulla have on each side of them deep red, highly congested, streaks, running parallel with the tubules.

I have more than once seen, when suppurative nephritis has affected granular cystic kidneys, the cysts containing pus, and looking like small circumscribed abscesses.

The microscope shows that, in many cases at least, the structural changes of suppurative nephritis are chiefly and primarily inter- or extratubular, and affect the epithelium of the urinary tubules to a less extent and at a later period in the disease.

These changes consist in an accumulation of small round cells, observed in very different degrees in different areas of the kidney, but nearly every part of the organ is more or less affected. In the less affected parts these small round cells are seen between the tubules only; in the next stage, the epithelium of the tubules is swollen and cloudy, then the epithelial cells are displaced, and surrounded by the same kind of small round cells as invade the intertubular connective tissue, and so on by degrees, until in the most advanced parts, epithelium and tubules and connective tissue alike disappear, and pus occupies the place of them.

The effect of this overgrowth, and cicatricial contraction, of the intertubular connective tissue, is to compress some of the tubules, and, as a consequence, to dilate others above the seat of compression.

Klebs, and following him, Ebstein, state that under high powers of the microscope the first changes which are to be seen occur in the uriniferous tubules, which become filled with small shining granules. These granules are colonies of bacteria. The epithelium lining the tubules at the same time becomes cloudy, the cells undergo segmentation, and the tubules themselves widen. Subsequently, the interstices between the tubules are also widened, and filled with the same kind of shining granules, and with more or fewer pus corpuscles.

English pathologists are not in accord with Klebs; nor are they, it must be admitted, with one another. Most, however, lean to the opinion that the initial changes occur in the interstices of the tubules, and the later ones only within the tubules.

Dickinson, whilst he is of opinion that the virus enters the kidney by the uriniferous tubules, considers that it passes thence into the veins, and is thus carried wide and far through the organ.

Marcus Beck thinks that the septic matter passes from the uriniferous tubules into the lymphatic spaces.

It is quite possible that both views are correct, and that in some cases the changes commence in the tubules, whilst in others they begin and are completed outside of them.

It seems to me that Dr. Lindsay Steven has shown how these opposite views may be reconciled. He tells us that there are two distinct ways whereby multiple abscesses may be excited in the kidney as the result of primary disease in the lower urinary tract; and that when the septic material or micrococci pass along the ureter to the tubules, the initial changes will be in the tubules, but when along the lymphatics they will be outside the uriniferous tubules. He further points out that these two methods may be combined and progress side by side.

When the virus obtains entrance by the lymphatics the small abscesses are most numerous, sometimes almost entirely confined to the cortex. The shape of the cortical abscesses when they spread inwards along the pyramids is *elongated or wedge-shaped;* but when, as is often the case, they are situated between the capsule of the kidney and the renal substance, and involve the capsule quite as much as the cortex, the abscesses are *oval or round.*

In their elongated and pyramidal shape and

cortical situation, these abscesses, due to lymphatic infection, differ from the suppurations occurring as the result of the entrance of the virus into the uriniferous tubules; and are easily distinguished from metastatic formations by the absence of evidence of embolism, namely, hæmorrhage, necrosis, etc. In connection with the abscesses, micro-organisms were discovered in large numbers. In the capsule of the kidney numerous colonies of micrococci were observed, and these were frequently seen lying in the lymphatic spaces surrounding the small capsular blood-vessels. Many of the small abscesses, in all probability, originate in the capsule itself.

Dr. Steven has shown by injections that the lymphatics of the ureter communicate with those in the cortex of the kidney; and this being so, his theory as to the infection of the kidney from the bladder by means of the lymphatic system is readily understood.

On the other hand, when the virus obtains entrance into the kidney along the uriniferous tubules, the colonies of micrococci, and the abscesses to which their spores give rise, are more numerous and larger in the pyramidal than in the cortical parts of the kidney.

Dr. Steven has no doubt about the correctness of the theory that the abscesses are due to micrococci, which obtain entrance into the genito-urinary system from without as the result of catheterism or other surgical interference. That in some places in the kidney these organisms are seen without any inflamed area around them, is explained by the view that the micrococci themselves do not cause the inflammation. It is their products (the threads and spores), not themselves, which are the exciting agencies of inflammation and suppuration.

Between the abscesses and the areas of intense

interstitial inflammation, the intervening tissue is scarcely, if at all, abnormal.

Cicatricial kidney.—When recovery occurs after acute interstitial nephritis, the kidney is granular and contracted, and often deeply and broadly scarred and puckered. This is the condition which has been called the "cicatricial kidney" (Marcus Beck), and is the result of an intertubular exudation of inflammatory material, followed by the contraction of this material. Sometimes this state is associated with the wasting and distension of the kidney, which are brought about by urinary obstruction. There is good ground for believing that under favourable conditions, and especially the amelioration or removal of the exciting cause, even small abscesses may be recovered from, the abscesses disappearing and leaving small scars or cicatrices in the renal tissue.

Dr. Moxon's * researches point to this termination of disseminated abscesses of the kidney, without being attended with very marked destruction of the kidney tissue.

Treatment of suppurative nephritis and pyelo-nephritis.—This is essentially the same as that recommended for acute and subacute nephritis without suppuration. Every precaution should be taken to prevent their occurrence. If there is any obstruction to the outflow of urine, or any incapacity to completely empty the bladder, it should be remedied or counteracted: thus, stricture of the urethra should be dilated or divided, vesical calculus should be removed, and the effects of enlarged prostate counteracted by the early and regular use of the catheter.

If chronic cystitis exists, daily irrigation of the bladder will be necessary, both to obviate decomposition of urine and to restore the mucous membrane to

* Moxon; "On Recovery from Surgical Suppuration of the Kidney;" Path. Soc. Trans., vol. xxiii.

a healthy state. If a stone is impacted in the lower end of the ureter, it should be removed through the bladder when possible; if impacted higher up in the ureter, or in the pelvis of the kidney, the question of ureterotomy, nephrotomy, or nephrectomy, must be considered.

Confinement to bed is necessary as soon as inflammation has once set in. With the view of obviating the tendency to inflammation which is prone to be excited by the use of instruments on persons with diseased kidneys, and more especially when men with enlarged prostates are commencing what Sir A. Clarke has recently styled "catheter life," absolute quietude and confinement to the same room, and to an equable temperament, should be enjoined before the introduction for the first time of any instrument at all. Whether with the object of avoiding the slighter forms of urinary fever, or the much more severe and dangerous changes of pyelo-nephritis, the above precautions should be strictly observed.

The bowels should be kept well opened, and for this purpose warm abundant enemata are of great and special service.

The diet should be light and moderate, and should consist chiefly of fish, milk, chicken, or game, light farinaceous and milk puddings, and well-cooked vegetables; uncooked vegetables or fruits and butcher's meats should be avoided. Stimulants should be taken, if at all, in very small quantities; and during their administration, if the pulse is quickened, the temperature raised, or the urine becomes more purulent, they should at once be discontinued.

Liquids should be taken in only moderate quantity if there is an abnormally large quantity of urine secreted; but where cystitis exists, and much mucus is passed in the urine, barley water, triticum repens, or linseed tea, are useful adjuncts in slaking thirst

and relieving the irritation of ammoniacal urine. As for medicines, but little can be said in their favour. From quinine and opium, combined, most good seems to result. A mixture of one gr. of quinine, ɱv to ɱx of tincture of opium, and grs. xx of citrate of potash in ʒi or ʒiss of mucilage, has proved of benefit in some cases.

When constipation exists, and a large quantity of urine is secreted, I have seen great benefit accrue from a few doses of ergot of rye. This drug, by acting upon the involuntary muscular fibres of the gut, overcomes the constipation, and by its influence on the coats of the blood-vessels restricts and regulates the renal circulation. The constipation, flatulence, atony of bladder, and general arterial and muscular feebleness, suggest remedies which will give tone and contractile force to the muscular fibres of the viscera.

When the febrile attacks take the remittent form, 5 grs. of quinine in ʒi of lemon juice, and ʒss to ʒi of liquor morphiæ, are sometimes very efficacious in checking the rise of temperature.

Traube obtained good results from injections into the bladder of acetate of lead, from half a grain to one and a half grains in ʒiv of distilled water; and the internal administration of pills of tannic acid (from one to one and a half grains) every two hours. He recommends both these remedies because of their antiseptic and antiphlogistic action. Drugs like tannin, alum, acetate of lead, and chloride of iron, which act as astringents upon the blood-vessels of the mucous membrane, and so lessen the excessive secretion of mucus, have been recommended, and certainly deserve fair trial.

LITERATURE.

"Nephritis and Pyelitis consecutive to Affections of the Lower Urinary Tract." By Marcus Beck, M.S. "Reynold's System of Medicine," vol. v.; 1879.

"On Renal and Urinary Affections," part iii.; 1885. By W. Howship Dickinson.
Medico-Chirur. Trans., vol. lvi.; 1873. By W. H. Dickinson.
"Urinary and Renal Diseases;" 1885. By W. Roberts, of Manchester.
"Diseases of the Kidneys," etc. By W. Ebstein. Ziemssen's "Cyclopædia of Medicine," vol. xv.
Rayer's "Traité des Maladies des Reins," tome i.; 1839.
"On Recovery from Surgical Kidneys." By W. Moxon. Path. Trans., vol. xxiii.
"Surgical Kidneys." By James F. Goodhart. Path. Trans., vol. xxiv.; and Guy's Hosp. Reports, third series, vol. xix., p. 357.
"Acute Suppurative Nephritis supervening on Chronic Disease of the entire Urinary Tract." By Henry Thompson (Sir Henry). Path. Soc. Trans., vol. vi.
"A Manual of Pathology." By Joseph Coats. 1883.
W. Watson Cheyne's translation of Dr. Robert Koch's "Investigations into the Etiology of Traumatic Infective Diseases." 1880.
"The Pathology of Suppurative Inflammation of the Kidney." John Lindsay Steven, M.D. *Glasgow Medical Journal*, September, 1884.

CHAPTER XXVI.

URINARY FEVER—URETHRAL FEVER—URÆMIC FEVER—CATHETER FEVER.

By **urinary fever** (the name suggested and used by M Guyon) is here intended the febrile disturbance which is aroused by the use of the catheter or bougie, or by an operation upon the urinary organs, or by a distinct impression made upon the urethra or bladder by some other means than these.

Urinary fever is of various kinds and of different degrees of severity. Hitherto it has only been described in males, and almost entirely in adult males; still, males under puberty have been smitten by the

acute, transient, or single paroxysm form; and I have once seen the recurring paroxysmal fever in a woman upon whom the catheter was daily used after ovariotomy. In a little boy, aged eleven, whom I cut for stone (the second operation after an interval of three years), there was a very sharp attack of urinary fever set up by the first act of micturition in the natural way after the operation.

Persons who have lived much abroad or in malarial districts are, it is said by Sir Everard Home, Sir J. Fayrer, and others, very prone to the congestive forms of the fever.

The inflammatory and suppurative forms occur chiefly, though not exclusively, in persons who are the subject of antecedent chronic renal changes; and such persons are more likely to succumb when attacked by the congestive forms of fever than others whose kidneys and ureters are normal.

In urinary fever there is always either a functional and transitory, or an organic lesion of the kidney; a simple congestion, or an interstitial nephritis, or disseminated suppuration of the kidney.

Under urinary fever, or one of its synonyms, cases of septicæmia, pyæmia, and uræmia have sometimes been described. It is well known to surgeons that each of these diseases occurs as an occasional result of suppurative inflammation in any part of the urinary organs; and that, too, whether instruments have been used or not. But excluding these diseases, all cases of urinary fever may be classified under one or other of the following heads:

1. Congestive; including (*a*) single paroxysm, (*b*) recurring paroxysms, (*c*) intermittent paroxysms.

2. Inflammatory; or fever due to acute interstitial nephritis.

3. Suppurative; or fever due to suppurative nephritis or pyelo-nephritis.

The second and third forms are clinically and pathologically the same as acute interstitial nephritis and suppurative nephritis respectively. When these forms of inflammation follow the use of instruments, or the commencement of catheter life, they are sometimes spoken of as "urinary fever" or "surgical kidney," whereas when they arise independently of the use of instruments they are designated, as they always should be, "acute" and "suppurative nephritis." Under these headings they have been described in the foregoing chapters.

Etiology.—Urinary fever is produced by local irritation in some part of the bladder or urethra, acting through the nervous system; primarily on the kidneys, and secondarily upon the whole system. When the irritation occurs in a person with healthy kidneys its effect on these organs is limited to a state of active congestion, which in most cases soon ceases, or is relieved by an increased secretion of urine. If the engorgement is so considerable as to amount almost or quite to a complete blockade of the renal vessels, there will be a partial or complete suppression of urine, which may be overcome after many hours; or, on the other hand, may end fatally within as short a time. In other cases even where the degree of renal congestion falls far short of this, death may occur in a few hours from the intensity of the shock to the nervous system, especially if the individual is delicate or if he has fatty kidneys (Fayrer), fatty heart, or any other organic disease.

When the same reflex irritation acts upon kidneys which have been already changed by obstruction to the outflow of urine, or by chronic Bright's disease, the acute congestion which ensues may so aggravate the pre-existing disease as to lead to acute or suppurative nephritis; *i.e.* to the inflammatory and suppurative forms of so called "urinary fever."

But it may be asked, "What evidence is there of all this?"

First, as regards the local irritation.—Unfortunately the mere passing of a catheter along a healthy urethra, into a healthy bladder, and in a person with healthy kidneys, has sometimes been followed by a rigor, faintness, and the excretion of but a small quantity of blood-mixed urine; or by an epileptiform seizure; or by complete suppression of urine; or by death. The patient may die within a few hours after the urethra has been interfered with, the unhappy victim being literally felled by the disease at its very onset (W. Mitchell Banks). Again, it is equally well known that the commencement of "catheter life" by an elderly man with enlarged prostate, or the performance of some simple operation for stricture of the urethra, has been followed within a few days or weeks by the death of the patient.

In such cases the mere passage of the instrument, or the performance of the operation, is the only new feature in the man's condition, and therefore the conviction necessarily forced upon us is that it is likewise the immediate exciting cause of death. Nor can it be accepted as an alternative explanation that septic matter had been introduced into the system on the instrument employed, because in many of the former class of cases this is quite out of the question, and in many of the latter the bladder contained foul decomposing urine previous to the use of the instrument.

It is a striking fact that urinary fever is not caused by severe injury to the urethra or bladder; nor by the introduction of a catheter in isolated fits of painful retention of urine. False passages, ruptured urethra, ruptured bladder, extravasation of urine, rarely, if ever, provoke it. It is generally some very slight interference with the urethra

in cases of long-standing disease of the urinary organs; *e.g.* the passage of a bougie in stricture, of a catheter in prostatic disease, of a sound in vesical calculous affection. Renal disease, stricture, enlarged prostate, any chronic disease of the bladder, and perhaps also malaria, are all so many predisposing causes of urinary fever; and the introduction of an instrument along the urethra is no doubt in the majority of cases the immediate and exciting cause. But it occurs after other forms of provocation; for example, after internal and external urethrotomy, the use of Holt's dilator, the passage along the urethra of bubbles of air or gas, of blood clots, of a renal calculus or a quantity of oxalate of lime or uric acid gravel, as well as when urine first flows again through the urethra after lithotomy. Sir E. Home speaks of it under "ague," as often following the application of caustic to a stricture.

Nunn and Henry Smith have recorded cases due to a small abscess just external to the bulb of the urethra.

It is not in any particular part of the urethra that the irritation must be made; urinary fever is provoked by causes acting in front of as well as behind the bulb, as for example when cancer of the glans penis opens into the urethra. (*See* page 409.)

It seems, therefore, that only certain impressions on the nerves of the urethra and bladder tend to produce fever; that these impressions may take effect on perfectly healthy organs, but are more likely to do so on organs long diseased; and that they may be modified or entirely counteracted by other nervous disturbances such as the pain of a greatly over-distended bladder, or of tissues lacerated or stretched by extravasated urine or blood. But be this as it may, the close connection of the urinary organs with the nervous system, and the nervous interdependence of

different parts of the urinary system upon one another, are well established, and have been testified to by a number of eminent authorities.

Anatomy as well as physiology confirms it. The lower urinary organs are richly furnished with nerves, both from the sympathetic and spinal systems. From the sympathetic through the pelvic plexuses; from the cerebro-spinal system through the sacral branches which join the pelvic plexuses. Through either of these sources reflex irritation of the kidney can be produced; for the nerve supply to the kidney is very similar to, and in anatomical relation with, that of the ureter, bladder, prostate, and urethra. The pelvic or inferior hypogastric plexuses are the continuation of the hypogastric plexus, as the latter is of the aortic plexus; and the aortic plexus in turn is connected with the semilunar ganglia (from the outer side of which the renal plexus emanates), and with the renal plexuses themselves. Moreover, in the solar plexus, of which the semilunar ganglia form so large a part, the great splanchnic nerve of both sides, and some branches of the pneumogastric nerve, terminate; the great splanchnic terminates in the semilunar ganglion itself, and frequently sends some filaments to the renal plexus; the small splanchnic also sometimes furnishes filaments to the renal plexus; and the smallest splanchnic ends in the renal plexus and inferior part of the cœliac plexus.

If, then, the nerve storm excited by the local irritation is at all severe, it is evident how wide-spread, through the sympathetic system, its effects may be; how easily the heart and general and pulmonary circulation are affected through the cardiac and pulmonary plexuses; and how syncope, impaired respiration, and epileptiform seizures or convulsive twitchings, may be produced through the effect of this storm upon the heart and cerebral circulation.

It should further be borne in mind, that besides supplying the renal artery (on which are placed the renal ganglia), the renal plexus of the right side also furnishes filaments to the vena cava; and in this way, by the relaxation of the coats of the vessels, which follows on their primary contraction, not only is more blood contained in the aorta and renal arteries, but more can be received, and more rapidly received, by the vena cava. In fact, the whole abdominal visceral circulation is increased, and herein is the explanation of the elevation of temperature, and the rigor or sense of chilliness of the surface of the body.

In the penis, the cavernous nerves of the sympathetic as well as the pudic distribute twigs abundantly to the fore part of the prostate and to the membranous and spongy parts of the urethra.

The nerves to the urinary bladder and back part of the prostate contain a large proportion of spinal nerves. These spinal branches are derived from the third and fourth, and sometimes the second, sacral nerves; and throughout the whole length of the sympathetic chain there is a regular and free connection with the spinal nerves.

Thus, then, any irritation in the urethra, prostate, or bladder will be conveyed along the spinal nerves, and be reflexed far and wide through the cerebro-spinal system, but especially through the sacral plexus; hence, probably, the muscular achings and pains which are so common in urinary fever; and hence, perhaps, the arthropathies (and their greater frequency in the knees and ankles than in joints of the upper limbs), which occasionally occur in urinary fever; and are the striking features of gonorrhœal rheumatism.

As regards the congestion of the kidneys.—The first effect upon the kidney, of a

stimulus to the sympathetic nerves is a contraction, followed after a time by a more or less prolonged dilatation of the renal vessels; whilst the effect on these vessels of stimulating the sacral or pudic nerves would be dilatation without previous contraction. But beyond this, the following facts in favour of a state of active hyperæmia of the kidneys in urinary fever may be quoted. 1. The appearance of albumen or blood in the urine within a short time after the onset of the fever. 2. The occasional entire suppression of urine. 3. The kidneys are found congested after death from urinary fever.

The sudden appearance of blood in the urine, whether the quantity of urine is less or in excess of the normal, points certainly to the conclusion that the kidneys are for the time actively congested. The sudden suppression of urine, lasting, as it does in some cases, for two or three days or more, cannot be due to prolonged spasmodic contraction of the arteries; whilst it is certainly proved in many cases to have resulted from such an amount of vascular engorgement as to have led to complete stasis in the blood-vessels of the kidney. In some cases blood has been seen extravasated into the tubules of the kidney. Sir Joseph Lister, Sir Joseph Fayrer, Sir Henry Thompson, Mr. Mitchell Banks, and others, have recorded cases of death from urinary fever, within a few hours or days, and in which the kidneys were more or less actively and intensely congested. On the other hand, Mr. Marcus Beck has recorded one case of suppression of urine and death on the third day, in which the microscopical examination of the kidneys led him to the conclusion that during the first few hours the renal vessels became dilated, and that then a considerable exudation of small round cells took place into the intertubular tissue throughout the kidney; this exudation at the same time compressed both the blood-vessels

and the renal tubules, and thus lowered the blood pressure in the Malpighian tufts, and obstructed the flow of urine in the tubules. In this manner equilibrium was produced between the blood pressure and the pressure of the urine in the tubules, all flow from the Malpighian tufts ceased, and complete suppression was the result. In this case the kidneys were large, tough, and pale in colour (anæmic, in fact), and quite free from vascular engorgement. Yet this was no proof that during life there had not been a period of acute congestion. It is only after a very careful microscopic examination that the kidneys can be pronounced free from the effects of such a degree of hyperæmia as may end fatally; and who can say what amount of congestion is required to cause death? Surely this, like the occurrence of urinary fever, or of gonorrhœal rheumatism, is a problem in which the individuality, or personal peculiarity, as it has been termed (T. W. Nunn), must play a large part.

If the kidneys are granular, or fatty, or have undergone chronic interstitial changes before active congestion is excited by reflex irritation, it is easy to see how acute or suppurative inflammation (the second or third form of urinary fever) may be rapidly induced.

But there is another way in which, after long-standing obstruction to the outflow of urine, the kidneys may become the seat of acute inflammation or suppuration. It is by the direct and mechanical effect of catheterism on the vascular condition of the kidneys. In kidneys long subjected to urinary pressure, a state of active congestion is brought about by the release of the distension by means of the catheter. This congestion is not only active in the ordinary sense, but it is much more, for it stimulates a degenerated structure into extra functional activity by bringing to the secreting apparatus, within a given

time, an extra amount of material for it to work upon. This increased flow of blood to the kidney cannot be even in part controlled or checked by the natural elasticity of the solid organs and their capsules, because the pre-existing chronic changes have led to the adhesion of the over-stretched capsule, not only to the degenerate renal substance, but also to the surrounding fatty tissue; and further, the elasticity of the renal substance itself has been destroyed by the intrarenal pressure of long pent-up urine. In this way do the inflammatory and suppurative forms of urinary fever set in upon the top of chronic interstitial fibrosis. The same mechanical effect is produced upon the mucous membrane of the bladder, but, in all probability, to a much less extent, because the bladder can collapse, and receives pressure and support from the adjacent intestines and other viscera. My belief is, therefore, that in these cases the morbid changes commence at once in the kidney, from which they perhaps spread downwards to the bladder; and not at the bladder to pass upwards to the kidneys. That this is so is clearly proved, in some cases by the chronological order of the symptoms, as well as by the post-mortem appearances of the urinary organs.

THE CONGESTIVE FORM OF URINARY FEVER CONSISTS OF THREE VARIETIES:

1. The acute transient paroxysmal fever.
2. The acute or subacute recurring paroxysmal fever.
3. The acute or subacute intermittent paroxysmal fever.

1. **The acute transient paroxysmal fever** varies much in intensity and duration. It may consist of a slight shiver or chill, followed by an elevation

of temperature of one or two degrees, and a sense of nausea, faintness, and headache, all of which symptoms clear off in from three to six hours; or it may be ushered in by a violent rigor and sudden elevation of temperature of from five to six degrees, and followed by sweating, vomiting, headache, pain in the neck, back, and limbs, injection of conjunctivæ, and more or less complete suppression of urine, and possibly by death. Sometimes the urine, instead of being suppressed, is secreted in smaller quantities than normal, is turbid, and contains albumen or blood. The temperature rises rapidly during the rigor, and remains high for a short time after the rigor ceases; it then falls by stages until it is again at normal, or slightly below normal during the sweating.

Such an attack, even when most severe, if it occurs in a young and healthy adult, or even in an aged person with healthy organs, will in all probability be recovered from, and in from twenty-four to thirty-six or forty-eight hours the patient will feel in his usual health again. If, however, the patient be infirm, weakly, or unhealthy; if he has a feeble, irregular circulation, a fatty heart, or some other serious organic lesion, he may succumb to the shock of the fever within as short a time.

A man whose kidneys are sacculated and granular may recover from a transient single paroxysm of urinary fever consisting of a rigor lasting eight minutes and a temperature of 102°. The accompanying chart (Fig. 33) shows such an attack in a patient aged seventy years, who had for years a narrow stricture which I gradually dilated to No. 8 English size. After an attack of apoplexy he developed pyelo-nephrits, and died with his kidneys in a state of advanced suppuration.

It has been stated by Phillips (1858), that unless the cause of irritation affects the urinary passages at,

or at a point behind, the bulb of the urethra, no urinary fever occurs. This, however, I am in a position to deny, as one of the most severe cases of transient paroxysmal fever which I ever witnessed occurred in an old gentleman, aged seventy-two, with cancer of the penis, in January, 1877. Whilst micturating, the disease suddenly opened into the urethra just behind the glans, and some of the urine dribbled through the fistula thus formed. He was at once seized with a rigor so severe that it caused him to fall, and was described to me by his nephew, who witnessed it, as appalling. It lasted about half an hour. On my arrival, an hour or more afterwards, the temperature was 103°. For several hours he

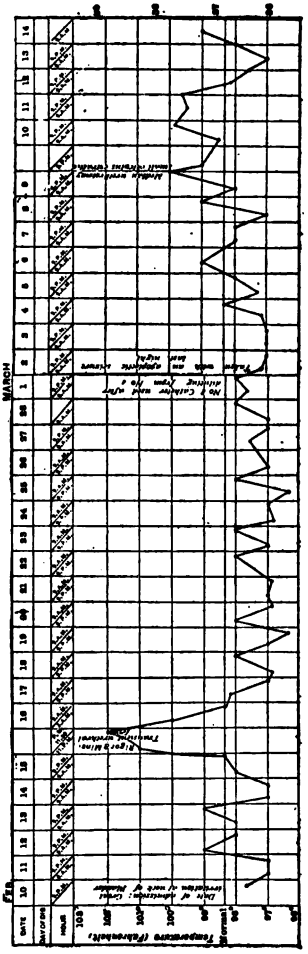

Fig. 33.—Temperature Chart in case of Acute Transient Fever: subsequent death from pyelo-nephritis.

remained in an alarming condition, faint, sick, aching all over, and with a tendency to delirium. By the next day he had quite rallied, and continued free of any similar attack until his death, from the cancer, nearly three weeks afterwards.

I shall, under intermittent urinary fever with swelling of the joints, refer to a case in which the fever was excited by irritation about an old fistula of the urethra, situated within one and a half inches of the meatus; and I shall also describe a case of the recurring acute paroxysmal form of fever due to the passage of a bougie through a stricture situated three inches from the meatus.

2. **The acute and subacute recurring paroxysmal fever** is very similar to the acute transient form just described, and varies in degree to the same extent. It differs from the transient form in being more prolonged than it, and in the repetition of rigors, and of the elevation of temperature. It rarely lasts for less than three days, and often continues four or five days, or a week. It has the same tendency towards recovery; but may terminate fatally when it occurs in the very aged, in persons of highly nervous organisation, or of delicate or unhealthy constitution. It commences in the same manner, with a slight or severe rigor, lasting from a few minutes to twenty minutes or half an hour, and coming on usually after the first act of micturition, though it may not be until after the second or third act, and is sometimes independent of micturition altogether. The temperature rapidly rises, until by the end of the rigor, or shortly after it, the thermometer reaches some point between 102° Fahr. and 107° Fahr.; it then declines by stages, and within six to eighteen hours will fall considerably, probably nearly to or below the normal. A second or third rigor will follow, and again the temperature will rise

three, four, or five degrees or more, and again it will subside steadily through a few hours. The variations in temperature may recur without a repetition of the initial rigor. These recurring rigors and alternations of temperature will take place once, twice, thrice, or oftener, and will happen within two successive days, or be spread over three or four or more days, according to the mildness or severity of the attack. Ultimately, when the fever has passed, the temperature falls to or below normal; if below normal, it may so remain for twenty-four hours, or longer, before it ascends to the healthy standard.

During the whole course of such an attack, the patient looks and feels excessively ill. When first seized he has a sense of the utmost exhaustion, may be too helpless to walk to his bed, or unable to undress himself. His face is dusky, his eyes suffused, tongue dry and coated, appetite quite lost; nausea or actual vomiting of a dirty greenish fluid distresses him, and he complains much of frontal headache, pain in the loins or hypogastrium, or back of his neck, or in his limbs. Perhaps he will express himself as being "sore all over," or say he feels as if he had been "beaten all over with a stick."

The urine will contain albumen or perhaps blood, or there may be partial or complete suppression. The bowels may be either relaxed or constipated, more often the latter. The condition of the skin is not the same in all cases; in some, profuse sweating follows each rigor; in others, there is no marked sweating stage, but after the rigors the skin is hot and moist, and later on is hot, dry, and pungent. With the permanent reduction in the temperature the other symptoms pass off, the appetite returns, the bowels act naturally, the urine is secreted in normal quantity, ceases to be tinged with albumen or blood, and resumes the normal specific gravity

and other characters; in fact, the patient is again well.

Both the transient paroxysmal and the recurring paroxysmal forms may occur again and again in the same person after fresh irritation; or, what is perhaps less frequent, the transient form may be excited at one time, and by one kind of irritation, and the recurring form at another time, or by a different kind of irritation.

I have before me the notes of a remarkable case of this kind. It occurred in a Dutchman, aged sixty-four, suffering from retention of urine and severe hæmorrhage into the bladder, due to an enormous number of small prostatic calculi.

It is a striking fact, and one which has great importance in treatment, that the division of a stricture of the urethra seems to take away the disposition to urinary fever. The case of the Dutchman just referred to, as well as the following, illustrated this.

A man, aged 39, was admitted under me on September 17th, 1883, with a stricture of the urethra situated about three inches from the external meatus. No instrument could be passed into his bladder. After rest in bed, and alkaline medicine taken for some days, gradual dilatation was commenced, and carried up to No. 6. Urinary fever followed.

On October 10th the stricture was dilated under chloroform by Holt's dilator to full size, and a No. 10 catheter was tied in the bladder. No rigor followed, and the evening temperature was 99·8° Fahr.; but the following day (October 11th) the temperature at four p.m. was 101·2°, and at nine p.m. 102° Fahr.; the catheter, which had been retained since the operation, was therefore removed. The next morning the temperature was 98·6° Fahr., and it remained normal throughout the rest of his treatment, which consisted of repeated introductions of the bougie.

My experience has forced upon me another fact which deserves mention. It is that cases are occasionally met with in which the same treatment or the same instrument will at one time excite urinary fever, though it has previously been employed with impunity. In other words, that a patient will sometimes develop an attack of urinary fever without any particular discoverable reason, and without any alteration in his treatment, or in the instruments used upon him. This is equally true of every form of urinary fever, whether congestive, inflammatory, or suppurative.

I have published a very typical case of the acute recurring paroxysmal form of fever, which well illustrates the fact to which I now allude.* The attack came on, without any special cause, during convalescence from an operation. The catheter had been used daily.

I have, on several occasions, known one solitary transient paroxysm to occur during a course of catheterism extending over some weeks.

The acute and subacute intermittent fever.—This form of urinary fever, except when associated with and due to interstitial nephritis, is probably very rare. When due to congestion, not to inflammation of the kidney, it may, like the other two forms, be either slight or severe. It may be either acute or subacute, that is, each febrile period may be high and the general symptoms severe, or the rise in temperature may be only moderate, and the general symptoms mild. In either case, the state of the patient between the febrile attacks is one of considerable improvement, though he will not describe himself as feeling well, and will, indeed, often say he is far from being so.

If any complication, such as swollen joints or effusion into the sheaths of tendons or other local

* *Med. Times and Gazette*, p. 224; August 24th, 1882.

trouble complicates the fever, the patient will have to keep his bed, and will be more or less severely ill throughout.

As a rule, the termination of these cases is favourable; the intervals between the accessions of febrile temperature lengthen; and after three, four, or more elevations, chiefly towards evening, the temperature keeps low, and the patient gradually recovers health and strength.

When the symptoms have been severe, and the patient much shaken by the fever, a herpetic eruption on the face has, sometimes, been the harbinger of recovery (P. Heron Watson). When the fever is going to take an unfavourable course, it assumes a continued form before death. This stage is marked by the same typhoid symptoms as are characteristic of interstitial nephritis. At the post-mortem examination the kidneys will be found inflamed or suppurating.

This intermittent form resembles, in some respects, the recurring paroxysmal fever; but with this difference, that in the latter the variations of temperature occur in quick succession, and within a limited space of time, whereas the intermittent fever lasts over some few weeks, or even months. But there are these further distinctions; the recurring paroxysmal fever comes on suddenly with a rigor within a few hours after the provocation, and the patient is very ill throughout the attack, from which, however, he, as a rule, recovers; and he does not suffer a relapse, except as the result of a fresh provocation. The intermittent fever often comes on insidiously, some days after the use of an instrument, or after exposure to some other cause of irritation; its onset is not always marked by a rigor; relapses take place without any fresh provocation from without; and the patient, as previously stated, has intervals of

comparatively fair health between one febrile period and another. It is this form of fever which is so often described as "*aguish;*" and surgeons ought to be familiar with the fact that some patients with stricture of the urethra are liable to these intermittent feverish attacks, and are frequently treated for ague. Enquiry in all doubtful cases of "aguish attacks" in adult males should always be made for, and will sometimes lead the surgeon to the discovery of, a long-standing stricture of the urethra.

The following is a case of subacute intermittent fever, due to the use of a large bougie.

A gentleman, aged fifty (who had lived fifteen years in India, had wandered all over South Africa, and had once spent ten days off Sierra Leone, the very hot-bed of ague, but had never suffered from that disease) consulted me about a urinary trouble. He complained that during the after part of the day he suffered from irritability of the bladder, and a slight dribbling of urine between the somewhat frequent and urgent acts of micturition. He had other symptoms, which caused several physicians to treat him for gout. I introduced a bougie, and found a stricture near the bulb, which, however, admitted No. 7; this was the first time in his life an instrument had been passed. The urethra was excessively sensitive, and soreness was felt each time he passed water for a week; but not a drop of blood escaped; he felt very unwell for some time after, but I had not the opportunity of observing his condition at that time.

On the 6th of May he came back, and Nos. 7, 8, 9, and 10 were passed. The same soreness followed as before. On May 9th, Nos. 9, 11, and 13 were introduced in succession; the first two with ease, but No. 13 gave some pain. More soreness than previously was felt afterwards during micturition, and

was most felt near the seat of stricture. No instrument was passed after this; but on the evening of May 13th (four days after the introduction of the bougie) he began to feel very unwell, and his temperature rose to 101·2°. Thus he continued for two days, but on the 16th he felt fairly well, and went out of doors for two or three hours. The next day (May 17th) he was seized with a sharp chill, about two hours after rising; and after the chill he sweated profusely, and felt as if he had been "beaten all over." His temperature rose to 102°. As the general muscular, or, as he called them, "rheumatic" pains subsided in other parts, they seemed to concentrate themselves in the calf of his left leg; but after twelve hours they disappeared from the left leg, and on the second day reappeared for many hours, and to the same degree, in the right calf. On the 27th May he was much better, and again went out of doors against my advice; but at 4 p.m. the temperature once more rose, this time to 101·6°, and at 10 p.m. to 102·6°. On the following morning, temperature being 100·6°, he vomited, and then fell into a cold sweat for one hour; the evening temperature was 99·6°. May 29th, morning temperature 96·8 (he had taken two doses, of 5 grs. each, of quinine, and also some brandy since the evening of the 27th); evening temperature 97·4°; he had more cold sweats in the early morning. From this date the temperature did not again rise; for several days, indeed, it remained subnormal (97·4°, 97·8°, and 98°, for example). The soreness in the urethra passed off, and with it the irritability of the bladder and the dribbling of urine, and he gradually returned to his previous good health. His urine, at the time of my first seeing him and up to this attack, was normal in colour, markedly acid in reaction, of sp. gr. 1012 to 1018, occasionally contained a few octahedral oxalate crystals, and in quantity averaged

30 to 35 ounces. He was a most regular and abstemious feeder, and almost a total abstainer from alcohol; he took meat only once a day, and but little of it then; he was active in habits, and fond of walking exercise, which he took freely. After the attack commenced, the urine was often thick and turbid, but contained no blood or albumen, and in quantity ranged between 28 and 38 ounces daily. There was absolutely no reason for thinking that this gentleman had chronic interstitial nephritis, or any other form of chronic renal disease.

I have no doubt that this attack of intermittent fever was excited by the passage of the large-sized bougie on May 9th, and that the only renal change was some slight temporary congestion, the result of reflex irritation. It is difficult to say why, in the absence of any further instrumental interference with the urethra, the second and third febrile disturbances occurred; probably they were excited by the passage of urine over the tender part of the urethra; but then, why only occasionally, and at intervals of days? The fact is parallel to what has been already stated respecting the two other forms of urinary fever; namely, their abrupt appearance during a course of catheterism or washing out of the bladder, although the same instruments and manipulations had hitherto caused no disturbance whatever.

Besides the rheumatic pains so much complained of in the above case, another symptom occasionally prominent in intermittent urinary fever is swelling of the joints. Perhaps the joints most commonly affected are the knees and ankles, but I have seen the elbows, wrists, and shoulders also involved. There is considerable swelling from effusion into the synovial cavity of the joint, but no redness, heat, or tenderness, although some amount of pain is complained of when the joint is moved. Sometimes

the sheaths of tendons are similarly swollen, and there may be also œdema of the cellular tissues of the lower limbs. I have seen the feet and legs pit on pressure. These cases are generally very chronic, three, four, and five months being required for their cure. During this period the patient feels excessively weak and depressed; and from time to time, at variable intervals (sometimes only of a few days), there is an exacerbation of temperature in the evening; 101° or 102° being often reached. On these days the patient feels worse, looks ill, has, perhaps, a dusky complexion, and loses his appetite entirely. The effusion into the joints and tendon sheaths is not, in the first place, purulent, and as a rule does not become so; but in aged or weakly subjects it may, just as the synovial fluid poured out after a slight injury occasionally does.

A man with stricture who is prone to "aguish attacks" may in one of them find himself affected by these arthropathies. Such a case came under my notice some time ago in the person of a well-known man who had often suffered from attacks of intermittent fever coming on without any known cause. He had "had such attacks all his adult life, and did not know to what they were due; they had sometimes been considered gouty." On my first seeing him during one of these attacks, his joints were for the first time affected in the way just described; but I learnt, moreover, that he had had a stricture of the urethra just behind the meatus, and a fistulous opening close to the stricture and under cover of the prepuce for over thirty-six years. There was a slight purulent discharge from the fistula, and some excoriation of the surface of the glans around it; a No. 7 catheter had been passed at frequent intervals during all these years. I now had no difficulty in understanding not only the existing attack, which I followed

throughout, but the previous attacks of which I had heard the description. The illness was protracted, many joints were involved, and for a while it was feared one knee joint would suppurate; but under the influence of tincture of iron internally, soothing and disinfectant washes to the fistula, and warmth and compression to the affected joints, a complete recovery with proper use of the joints was obtained in from four to five months, between two and three of which had been passed in bed.

Prognosis.—It is exceptionally rare for any serious termination to follow either of the above types of urinary fever, even though the attack be violent. When the kidneys are healthy the febrile storm, however appalling for the time, generally passes over, and the victim of it soon recovers. Even though the urine be completely suppressed for many hours, recovery under appropriate treatment is the rule. I have never had a fatal case in my own practice, nor have I known of one in the practice of my colleagues. It is, however, undeniable that death is caused by each form of the fever; and fatal cases, in which no *organic* disease of the kidney was found, have occurred to Mitchell Banks, H. Smith, Fayrer, Lister, Henry Thompson, Velpeau, Heyfelder (of St. Petersburg), and others. When antecedent renal disease exists rapid death is by no means unfrequent as the result of the acute paroxysmal, or recurring paroxysmal, seizures (Beck, Erichsen, and others); and a fatal termination is only too frequent after two or three weeks as the result of acute or suppurative nephritis. (*See* Acute interstitial nephritis, and Pyelo-nephritis.)

Evil consequences short of death may ensue. Sir B. Brodie has recorded a case in which the introduction of a small gum catheter through a stricture was followed by a severe rigor and an attack of fever attended with rheumatic inflammation of the muscles

of the neck, from the effects of which the man never entirely recovered. He also alludes to another case in which a rigor followed the application of caustic to a stricture, and an attack of mania lasting nearly one month was the sequel.

Diagnosis.—The congestive forms of urinary fever are to be distinguished from the inflammatory and suppurative forms (*i.e.* from acute interstitial nephritis and suppurative nephritis) by the suddenness and rapidity of the symptoms, and the short duration of the fever; by the clinical history of the case, and often by the presumably healthy state of the kidneys; and especially by the state of the lower urinary passages at the time of the fever. The intermittent fever is the form most likely to be confused with interstitial nephritis, but with care will generally be distinguished.

From **pyæmia** the two first forms of congestive fever are to be distinguished by their rapidity and severity of onset; their short duration, the absence of delirium and metastatic abscesses. The third form, especially when complicated with joint swellings, is more likely to be mistaken for pyæmia, but it is diagnosed by the absence of redness and tenderness of the swollen parts, as well as of the frequent rigors and subsequent profuse sweats, the delirium, high pyrexia, as well as the irregularly recurring exacerbations of fever, the metastatic abscesses, foul breath, and icteric coloration of the skin, which are noticeable features of pyæmia.

From **uræmia** the diagnosis is much more difficult. It must be remembered that in some of the fatal cases of urinary fever there is complete suppression of urine for several days, so that the mode of death is partly by way of uræmia. But in the more rapidly fatal cases death occurs before uræmia could take effect; moreover, in cases of suppression large

quantity of urea is got rid of by vomiting; and, finally, in some few fatal cases there is no suppression. The absence of coma, drowsiness, and convulsions, and (after the rigor has passed off) of blueness or lividity of the skin; and the retention of consciousness, will serve to exclude uræmia.

Septicæmia plays a by no means insignificant part in certain cases of acute and suppurative nephritis; but except in cases of the intermittent form of urinary fever which go on to a fatal result, there is no resemblance between the congestive forms of urinary fever and septicæmia. The insidious onset and low typhoid character of septicæmia when arising from the absorption of pus or putrid urine from the kidney or urinary passages, mark it off from the two first forms of congestive fever; and the continuous and rapidly progressive course of the disease distinguishes it from the intermittent or third form.

Ague ought not to be mistaken for urinary fever, nor the fever for ague. The sudden onset; the presence of stricture or a known cause of irritation in the urethra or bladder prior to the rigors and feverishness; as well as the absence, in many cases of urinary fever, of all malarial influences; and, finally, the complete cure of the "aguish" symptoms, by the cure of the stricture of the urethra or the removal of other source of urethral or vesical irritation, will serve to distinguish urinary fever from ague.

Gonorrhœal rheumatism.—Urethral arthropathies are excited by other causes than gonorrhœal urethritis. Any purulent discharge from the urethra, balanitis, and, in the female, vaginal and cervical leucorrhœa, as well as gonorrhœa, have been known to cause them. Hence, when fever, complicated with swelling of the joints, and a urethral purulent discharge, comes on in an adult who has stricture of the urethra, the diagnosis between urinary or urethral

fever, and gonorrhœal synovitis or urethral rheumatism, is impossible. Probably they are one and the same disease.

From another form of gonorrhœal rheumatism, that, namely, in which the fibrous tissues of the joint are chiefly, and the synovial membrane only secondarily affected, urinary fever is to be distinguished: (1) by the presence of diffuse, sometimes widely diffuse, redness and pain in the tissues over the inflamed fibrous structures, and of the softening, and consequent abnormal movements which may be communicated to the joints in gonorrhœal rheumatism; (2) by the more severe constitutional disturbance and more marked synovial effusion in urinary fever; (3) urinary fever occurs generally in males, and is commonly associated with stricture of the urethra; (4) in urinary fever, complicated with joint affection, there will sometimes be a past history of previous and repeated "aguish attacks" in which the joints were quite unaffected; (5) gonorrhœal rheumatism occurs in young persons, in females as often as, or even more often, than in males; it comes on during the acute stage of gonorrhœa, or of some other purulent discharge from the genital organs; and is apt to be confounded with phlegmonous erysipelas, lymphangitis, or phlebitis. It seems to be very prone to affect recently-seduced girls and young married women who, having a purulent discharge, are also pregnant;* (6) gonorrhœal rheumatism is often complicated by inflammation of the sclerotic or iris; it rarely or never causes suppuration of the joints, but is prone to terminate in fibrous ankylosis.

In gonorrhœal rheumatism and in urinary fever several joints may at first be affected, as in acute

* For an excellent account of acute gonorrhœal rheumatism the reader is referred to an article by Mr. Davies Colley in the Guy's Reports for 1882.

rheumatism; but later on one joint becomes chiefly implicated; in both diseases the evening temperature will often rise to 101° or 102°; and in both, the general and arthritic symptoms will improve with the cure of the urethral or other purulent discharge on which it depends.

Pathology. — The pathological changes in urinary fever have been indicated under the etiology of the disease. In urinary fever, as distinct from the fever of acute and suppurative nephritis, the only pathological change discoverable outside the urethra and bladder, is more or less congestion of the kidney. The degree of congestion varies from a slight mottled redness to the most intense engorgement of the renal vessels, extravasation of blood into the renal tubules, and greatly increased softness and friability of the renal substance. The almost complete absence of congestion found after death in some fatal cases is no criterion of the state during life. After death the renal vessels, which during life were over-distended, rapidly empty themselves, and the blood flows back into the large abdominal vessels. How little evidence may remain of the severe shock which during life had caused a sharp and fatal paroxysm of fever is seen in Mr. Mitchell Banks' case. Half an hour after a No. 4 metallic bougie had been passed through a tight penile stricture the patient vomited, had a rigor, followed by a second rigor in two and a half hours, and death in six and a half hours. At the post-mortem there was no injury of the urethra or laceration of the stricture, and only slight congestion of the kidneys; a tablespoonful of thick muddy urine was in the bladder, and a little thick turbid urine escaped from the calyces of the kidney on pressure. In other cases, on the other hand, as Lister's and Henry Thompson's, for example, the kidneys were found in a state of the most intense congestion; in

Lister's case of rapid death preceded by complete suppression of urine, the kidneys, which had been previously perfectly healthy, were "affected throughout with most intense inflammatory congestion."

In Thompson's case death occurred within fifty-four hours of passing an instrument through a narrow stricture; the kidneys were found "congested to an extraordinary degree, and their substance was so soft and friable as to give way under gentle pressure. Very rapid changes had evidently taken place in these organs, but no sign whatever of inflammation existed in any other part of the urinary apparatus."

No doubt the appearances vary according to the length of time between the initial rigor and death; when several hours have elapsed the renal changes may be expected to be most marked, when only a few hours have been lived, as in Mr. Banks' case, the post-mortem signs of congestion are perhaps slighter.

In cases of intermittent urinary fever, which have passed into a continued fever, and then ended fatally, the kidneys have usually become the seat of acute inflammation or suppuration; this, however, may only be discoverable by the microscope. In other cases in which the kidneys have been found healthy death has been caused by chronic cystitis; or septicæmia, the result of absorption of septic material from the putrid urine. It has been contended in a recent discussion on "catheter fever," that fatal cases of a low continued fever arise from the use of the catheter, and that an autopsy reveals no definite visible structural lesion adequate to account for death. When this is true as regards the kidney, and it very rarely is so, cystitis is found, and the bladder is the reservoir of decomposing mucus and urine; its "mucous lining congested and in part eroded, and everywhere coated with a greyish-white stinking mucus" (Sir A. Clark), has doubtless

been the starting point of blood poisoning. In such cases it matters little whether the ureters, pelves, and substance of the kidneys are inflamed or not; septicæmia can arise from the absorption of putrid urine from the bladder or urethra. Such cases may properly, perhaps more properly than by any other name, be called urinary septicæmia; but they are improperly called catheter fever, because they are not set up entirely through the irritation of catheterism, and may occur quite independently of the use of instruments.

The pathological cause of the joint troubles in urinary fever, as well as of the muscular or rheumatic pains, is not yet understood. The synovitis and arthritis of gonorrhœal rheumatism have been regarded as a form of pyæmia or blood poisoning, but I do not think such a theory sufficiently justified, at any rate not in the case of urinary fever. I am of opinion that the effusion into the joints and tendon sheaths is due to the same reflex disturbance of the vaso-motor system, through irritation of the nerves of the urethra or bladder, as causes the congestion of the kidneys. In the paroxysmal forms of fever this disturbance, though more severe, is more evanescent; in the intermittent form, though the storm is less violent, it is more lasting, and has time to produce its effects beyond the central sympathetic plexuses. Both the synovial effusion and the "muscular" pains are, I think, due to increased capillary tension; and in the rare cases of suppuration of the joints it is quite possible to understand, from analogy with other cases of synovitis, without resorting to the theory of blood poisoning, how the effused fluid assumes a puriform character.

Treatment.—The surgeon's efforts should be directed to the prevention as much as to the cure of urinary fever. To avoid shock, convulsions, or any of

the paroxysmal forms of urinary fever, it has long been the practice to prescribe a dose of hot spirit and water immediately before, or after, the first introduction of an instrument; to which, for nervous or excitable persons, or those whose urethra is very sensitive or irritable, a few minims of Tr. opii may with advantage be added. If there is any known tendency to urinary fever, or if the patient has lived in the tropics or been the subject of ague, two minims of Fleming's tincture of aconite, or 5 to 20 grains of quinine in lemon juice with or without 3ss to 3i of liquor morphiæ, should be given at once after the use of the instrument; or a short course of these drugs should be tried for a few days, or a dose of opium or a subcutaneous injection of morphia should be given immediately before. In highly nervous persons, and in those who are mentally or physically much depressed or excessively sensitive to pain, it is well to give an anæsthetic before introducing an instrument at all. It is by no means those who suffer most from catheterism who are most prone to urinary fever; but manipulations under chloroform are very much less likely to be followed by urinary fever than when made without the aid of anæsthesia. I have known a person suffer urinary fever from the simple passage of a bougie, who has borne prolonged manipulations under chloroform without having any ill effect.

In cases in which the urethra alone requires to be examined, it is not necessary to take further precautions than those just named. But in a person whose bladder is to be explored, or the regular use of the catheter for retention commenced, previous rest upon the sofa or bed for two or three days is desirable; and the instrument should be first used, not in the consulting room of the surgeon, but in the bedroom of the patient.

To explore a bladder for stone without previous

preparation of your patient, or to empty the bladder of a man with enlarged prostate, who up to the time of his consulting you has been going about his business as usual, are things to avoid when possible. Many a patient under these circumstances has experienced a sharp chill or an attack of urinary fever, who subsequently to resting might have borne the use of instruments with impunity.

It is true that in the out-patient department of a hospital it is not practicable to insist absolutely on every patient who requires the catheter or a vesical exploration resting for a day or two beforehand; and it is fortunate that in the very urgent cases, viz. those of painful retention of urine, catheterism does not appear to excite urinary fever. But it is often possible to make some amount of preparation, *e.g.* to get the bowels well open by gentle saline purgatives, to regulate the diet, and avoid excessive exercise or fatigue, and perhaps to undergo a course of quinine, aconite, or arsenic for a few days or a week.

The enthusiasm of house surgeons and young practitioners to make a good diagnosis and discover an "interesting case" should not lead them to explore the bladder of any patient hastily or recklessly; it is a light matter to them to introduce a sound, but it may turn out to be a most serious one to the patient. Rather let it be a rule of practice to prepare a patient just as if he were about to undergo any other ordinary surgical operation. Having decided that "catheter life" must be commenced, or a sound introduced into the bladder for the purpose of diagnosis, the surgeon should insist on some such preparation as I have indicated, and if it can be continued for four or five days so much the better for the patient.

When any operation such as urethrotomy or lithotrity is to be undergone, still more necessary is previous preparation. In lithotrity the urethra

should be educated for a day or two by degrees for the reception of the lithotrite by the daily introduction of soft and flexible instruments of increasing size, as recommended by Civiale. In all cases, no matter what the nature of the disease, the utmost gentleness in handling, and deliberateness in moving, an instrument within the urinary passages are essential; force is never justifiable in introducing an instrument, and roughness when once it is within the bladder cannot be too strongly condemned.

That a certain amount of force is necessary in the use of the internal uretrotome, and Holt's dilator is quite certain; but this force is exercised under the controlling action of a guide or director, and is regulated to the requirements of the individual case. And although it is true that by the division of the stricture, and thereby the removal of the obstacle to the outflow of urine, the patient is freed from one of the causes of urinary fever, yet it must be confessed that, in spite of the advantages gained by them, these very operations are amongst the most frequent excitants of the fever in its most severe forms.

Force, when used upon the bladder, whether by sounding it roughly, or by distending it abruptly, is never free from danger; and it has been said by M. Guyon, though I cannot confirm the statement from my own experience, that the fever which results therefrom is proportionate to the violence inflicted.

An instrument which is to be tied in the urethra should not be sufficiently large to quite fill the canal or stretch the stricture. If the urine is in a very bad state it should be improved prior to an operation, when time permits; this is done by irrigating the bladder daily with Condy's fluid in warm water, boracic acid, salicylate of soda (grains 4 ad ʒi), acetate of lead (grain 1 ad ʒiv), or by one of the many other medicated solutions recommended for the

purpose in works on diseases of the bladder and urethra. It is scarcely necessary to say that every instrument the surgeon uses should be scrupulously clean; and in urinary operations this is a point of great importance; but when it is seriously advised by a professor of surgery that a catheter before being used should be boiled, then put into cotton wool while it cools, so as to keep off septic organisms, and then anointed with carbolic oil, one knows that the advice is impracticable, though it would not be becoming to call it ludicrous.

In old men with prolonged partial retention the urine should be drawn off slowly, and always while the patient is in the recumbent position, and under circumstances which will ensure rest, quietude, and an equable temperature for two or three days after the first catheterism. The object in these cases is to favour the gradual and safe, and to avoid the sudden and dangerous, change in the intrarenal pressure by the withdrawal of long pent-up urine; and unless the patient will consent to the above precautions it is the surgeon's duty to decline to interfere. In all cases it is desirable to protect the patient from exposure to cold or fatigue after the use of either catheter, bougie, or sound, as well as after any operation on the urinary organs. The slightest chilliness afterwards, especially if followed by headache, sickness, or scanty secretion of urine, should be at once treated by confinement to bed, a dose of brandy or other diffusible stimulant, restricted simple diet, warm drinks, and hot fomentations to the loins and hypogastrium; the vapour bath as a means of provoking perspiration may be employed with benefit in this stage as well as during the course of more pronounced fever.

As soon as the initial rigor has occurred, and the fever sets in, it becomes, if possible, even more

necessary to keep the patient's skin warm, and, indeed, to provoke free perspiration. With this object he should be covered with blankets, and the steam or hot air bath should be used. Hot tea, in large and frequent draughts, is a favourite and useful beverage, and great benefit is very often derived from the rapid and diffusible stimulant effects of one good dose (℥ss to ℥iss) of brandy or rum added to the tea or taken in hot water.

If there be diarrhœa, as there sometimes is, nothing need be done to check it, especially if partial or complete suppression of urine complicates the fever. Sweating and diarrhœa are the two great means of eliminating that which the kidneys are failing to remove from the blood. On more than one occasion I have had reason to be satisfied with the result, when, instead of sanctioning, I have objected to anything being done to check diarrhœa; but, on the contrary, have regarded the symptoms as a reason for giving a good prognosis. The one precaution which is requisite, when diarrhœa occurs, is to take care that the patient incurs no chill while passing his stools, and to this end the bed-pan or draw sheets must be used, and the body kept well covered during the proceeding.

Diet is a matter of the first importance, and those patients are fortunate who like and can digest milk. Milk is the appropriate and indeed the only fitting diet in urinary fever. Solid food of any kind is out of the question as long as fever deprives the mouth of saliva. Beef tea and the extracts of meat are unsuitable during the functional imperfection or inactivity of the kidneys. If there is a tendency to acid fermentation in the stomach or to sickness, lime-water should be added to the milk; or Vichy water may be taken between the draughts of milk, or just after them. Equal parts of milk and barley water is a very useful drink. If sickness without diarrhœa exhausts the

patient, enemata of milk and eggs with a little brandy should be given. Stimulants are sometimes needed throughout the attack, but except in a single dose at the onset, or after recurring rigors, they should be given with caution. When the bowels are costive, as they very often are, some saline aperient should be given as soon as the high temperature declines; warm laxative enemata are also of the greatest service in urinary fever, as well as in all prostatic and vesical troubles. The medicines which enjoy most repute are quinine and tincture of aconite. I am in the habit of ordering five to ten grs. of quinine in lemon juice, combined with ℥ss to ℥j of brandy, and ℥ss of liquor morphiæ, every four or six hours, as long as the temperature keeps above 100°. Sometimes the second dose is given within two hours of the first, if the rigor has been very severe, and the temperature keeps very high. This treatment has been very satisfactory in my hands, but it is useless in cases in which there is suppression of urine.

Morphia, by increasing the action of the skin, relieves the congested blood-vessels of the kidneys. When there is suppression of urine in persons without organic renal disease, I have seen most marked improvement follow the subcutaneous injection of $\frac{1}{120}$ gr. to $\frac{1}{80}$ gr. of atropine, with $\frac{1}{8}$ to $\frac{1}{4}$ gr. of morphia. In the case of the Dutchman, previously alluded to, one such injection of $\frac{1}{120}$ gr. of atropine with $\frac{1}{8}$ gr. of morphia, checked vomiting and induced sleep immediately; and ℥iv of urine were excreted at the end of six hours, though the suppression had lasted for forty-three hours before the injection was given. The vomited matter in this case contained (by Russel and West's test) 2·7 per cent. of urea, and as a large quantity of fluid was ejected, and the kidneys were perfectly healthy, the patient was not comatose, and made a rapid recovery. If organic disease of the

kidneys is present there is with some a fear of morphia inducing coma.

P. H. Watson's experience is in favour of quinine and digitalis, given for some days before the first introduction of the catheter; and bromide of potassium or an opiate for twenty-four hours afterwards. He also strongly recommends the internal use of perchloride of iron throughout the whole period of the fever.

I have tried, in one case, one-eighth of a grain of pilocarpin subcutaneously injected; it created a marked effect upon the skin by increasing perspiration.

Gouley, of New York, and Harrison, recommend for its diuretic action a teaspoonful of infusion of digitalis every hour or two; the action of this drug upon the circulation requires, however, to be closely watched.

In the intermittent form of urinary fever, close attention to the digestive and excretory organs should be paid during the intervals between the paroxysms of fever. Regularity of the bowels; simple bland diet, with little or no butcher's meat, but consisting of milk, milk pudding, fish, game, fowl, and cooked vegetables; warm clothing; and a mixture composed of mineral acids, and bark or quinine, are the lines of treatment to employ. With some persons a moderate allowance of claret or some light wine is beneficial. Tincture of iron through this form of fever is one of the most valuable remedies. When the joints are affected an application composed of iodide of potassium 3ij, glycerine ʒij, spts. vin. rect. ʒij, aquæ ʒvj, should be painted over the affected joint, which should then be covered with a thick casing of cotton-wool, retained by an elastic bandage. If there be much effusion, and rest and remedies do not remove the fluid, the aspirator should be used; its employment should not be long delayed, as its timely and judicious use saves many joints from suppurating. Rest in bed,

with the application of splints to the affected limb, is absolutely requisite for a good recovery. Recovery in these cases must not be looked for in less than several weeks.

In certain cases surgical treatment is indicated as a curative means. Whenever there is any urethral discharge it must be checked by appropriate injections. Urethral fistulæ should be healed, and if this is difficult or impossible to accomplish, they must at least be kept clean and free of purulent or urinous secretions. I have already mentioned a case of stricture of urethra, in which a disposition to urinary fever was cured by Holt's dilator; and in the case of the Dutchman above mentioned, repeated attacks of fever occurred until internal urethrotomy was performed, and completely destroyed the febrile susceptibility. The effect of the operation in this respect was very striking. M. Guyon has observed the same thing, and, with full knowledge of this fact, has even operated during the height of an acute paroxysm, with excellent result.* He regards the tendency to urinary fever possessed by some patients with urethral stricture, as one of the indications for urethrotomy. Sir Henry Thompson, in his recent lectures at the College of Surgeons, has drawn attention to the same thing.

In cases of imperfect, frequent, and painful micturition, whether due to stricture or to enlarged or inflamed prostate, in which there is a repetition of, or a tendency to, attacks of urinary fever, a cure may be effected by internal or external urethrotomy, or the regulated evacuation of the bladder, according to the special requirements of the case. It can, however, but rarely be justifiable to operate during a paroxysm of fever, but, as a rule, the surgeon ought to wait for the complete subsidence of the attack before again interfering with the urinary passages.

* Guyon; "Les Maladies des Voies Urinaires," p. 569.

WORKS ON URETHRAL, URINARY, URÆMIC, AND CATHETER FEVER.

Literature.

Velpeau: "Leçons Orales de Clin. Chir.;" also "Dictionnaire de Médecine," 2nd ed., 1883.

Civiale: "Traité pratique sur les Maladies des Organes genito-urinaires."

Perdrigeon: "Thèse de Paris," No. 93, 1853.

Heyfelder: "Deutsche Klinik," No. 35, 1857.

Wolff: "Berl. Med. Zeitung," No. 42, 1858.

Long: *Med.-Chir. Rev.*, January, 1858.

Brodie: 3rd ed., 1842.

Marx: "Des Accidents Fébriles à forme intermittente, et des Phlegmasies à siége spéciale qui suivent les opérations pratiquées sur le Canal de l'Urèthre," Paris, 1861; and Sydenham Society's Year Book, p. 304, 1863.

Moffait: "Thèse de Paris," No. 13, 1810.

Phillips, Ch.: "Traité des Maladies des Voies Urinaires," 1860; *Med. Times and Gaz.*, vol. ii., p. 119, 1859; and "Bull. de Thérapeut.," tome iv., pp. 203-216.

Sedillot: "Comptes Rendus," liii., Nos. 19 and 21; *Brit. and For. Med.-Chir. Rev.*, p. 547; 1867.

Guyon: "Leçons Cliniques sur les Maladies des Voies Urinaires," 1881.

Röser: *Brit. and For. Med.-Chir. Rev.*, vol. xl., p. 529; 1867.

Fayrer: "Clin. and Path. Observations in India," 1873; and *Med. Times and Gazette*, 1868.

Nunn: *Lancet*, vol. ii.; 1871.

Banks, Mitchel: *Edin. Med. Journal*, p. 1074; June, 1871.

Clark, Sir A.: *Discussion on; Lancet*, vol. ii., 1883; and also *Edin. Med. Journ.*, April and May, 1884.

Cameron: *Glasg. Med. Journ.*, March, 1884.

Home, Everard: "Practical Observations on the Treatment of Strictures in the Urethra," 2nd ed., p. 483; 1797.

Beck, Marcus: "Reynolds' System of Medicine," vol. v., 1879.

Holmes: "System of Surgery," vol. iii., p. 211. 3rd ed.

Malherbe: "De la Fiévre dans les Maladies des Voies Urinaires," 1873.

Paget, Sir James: "The various Risks of Operations." Lectures.

Erichsen: vol. ii., p. 750; 7th ed.

Bryant: "The Practice of Surgery," 4th ed.

Harrison: "Lectures on Surgical Disorders of Urinary Organs."

Morris, H.: *Lancet*, vol. ii., p. 1080; 1883.

CHAPTER XXVII.

HÆMORRHAGE FROM THE KIDNEY A RESULT OF CATHETERISM.

One of the occasional disasters of catheterism is hæmorrhage from the kidney. I have seen it once in prolonged retention from prostatic enlargement, as a result of a first introduction of a catheter.

It is in elderly men with prostatic disease, and who for a long while have but imperfectly emptied their bladder, that this accident is chiefly met with; but it might happen also in young men, after a fit of extreme and painful retention, who are much debilitated or who have a tendency to bleed.

The source of the blood is the mucous membrane of the pelvis and calyces of the kidney, the blood-vessels of which become over-distended, until one or more of them give way, as soon as the intrarenal pressure of retained urine is removed. The escape of blood is the effect of intense hyperæmia; it is an evidence of the state of congestion or active engorgement of the vessels of the mucous membrane of the renal pelvis, which is caused by the sudden change from great compression of, to sudden lack of support to, the renal circulation; and the more complete and rapid the withdrawal of urine, the more is this state of active congestion favoured.

Symptoms.—The hæmaturia occurs after the withdrawal of the urine, no blood being noticed in the urine which is taken away the first time the catheter is used. On the second occasion the urine withdrawn will be from first to last mixed with blood, to a greater or less extent, according to the degree of congestion, or the number and size of the vessels

which have given way. Subsequently, each act of micturition, or each introduction of the catheter, for a day or two or several days, will be attended with the escape of blood mixed with the urine throughout; not flowing first or last only, but admixed with all the urine discharged. Syncope, even fatal syncope, is one of the gravest accidents of catheterism, but is not specially noticed in these cases of hæmorrhage.

Sometimes no indication of anything wrong will be experienced until the blood is actually seen; in other cases, the great relief which the withdrawal of the urine affords from the pain and discomfort of retention will be followed within a few hours by restlessness, and pain in the neck of the bladder, at the hypogastrium, or in the groins; or a sense of weight and bearing down will be felt in the perinæum, accompanied, perhaps, with much spasm of the bladder, and a frequent desire to void the contents of that viscus. Dr. Cameron has recorded a case* of an old gentleman, for whom he passed a soft catheter, and drew off a large quantity of clear limpid urine. In the evening of the same day he again passed the catheter, and the urine then drawn was from first to last extremely bloody; the urine continued bloody for several days, but ultimately became clear, and was spontaneously voided. This attack of retention seemed an almost accidental one in the course of a prolonged illness, which ultimately proved fatal. Dr. Cameron had some time previously sounded this patient's bladder, without the slightest bleeding or other ill consequence. Nor does he mention that any symptom, other than the blood in the urine, was set up by the presence of the blood in the bladder. On the other hand, in the case which came under my own care, the hæmorrhage gave rise to much bladder trouble, to frequent and painful spasms, and as there

* *Glasgow Med. Journal*, March, 1884.

was complete retention from enlarged prostate, I performed external urethrotomy, and drained the bladder through a large indiarubber tube. The bleeding gradually diminished, and altogether ceased in three or four days; but was followed by a slight amount of pus in the urine, which continued for a week or two. The patient ultimately quite recovered, though since then he has had occasionally to use the catheter on account of the prostatic enlargement. Perhaps it is the liability of the hæmorrhage to be followed by pyelitis and cystitis, rather than the actual loss of blood, which is the source of chief danger. If the bleeding is very free, clots are formed, either in the pelvis of the kidney or bladder. If in the kidney, the passage of the clots along the ureter will give rise to symptoms resembling renal colic. If the clotting takes place in the bladder, the symptoms will be referred to the bladder and urethra.

Diagnosis.—First, the source of the hæmorrhage has to be localised; and secondly, having decided that it is the kidney, other causes of renal hæmorrhage, such as injury, cancer, tubercle, calculus, etc., must be excluded.

Urethral hæmorrhage will easily be negatived, because the blood from this source flows independently, or at the starting, of micturition. Prostatic hæmorrhage can usually be excluded on the same ground; but if the blood comes from the back part of an enlarged prostate, and trickles therefrom into the bladder, some confusion may arise if the urine drawn off at the first use of the catheter was clear.

From the prostate, under these circumstances, as well as from the bladder, the urine last passed will contain the most blood; and often the last drawn away is almost pure blood, and great pain is suffered as, and after, it flows. Hæmorrhage from the mucous membrane of the bladder, or from a prostatic

enlargement projecting into the bladder, is occasionally, brought on from the same cause, and in the same way as the renal hæmaturia now under consideration. Vesical hæmorrhage is less likely to occur than hæmorrhage from the kidney, because, being a hollow collapsing organ, the mucous surfaces fall together, and receive some support from the impact of the surrounding viscera and intestines; whereas the kidneys are too often diseased, the renal capsule thickened and stretched by the expanded kidney, and adherent to the circumrenal fat, so that the loss of the intrarenal pressure is not made up by any counterbalancing compression from without. When the blood comes from the bladder, not from the kidney, it will sometimes flow with the last few drops of urine at the first introduction of the catheter, all the rest of the urine being clear; whereas, when it comes from the kidney it is equably mixed with the second and subsequent evacuations of urine, the first evacuation drawn being quite clear. It may come from kidneys and bladder too, as the result of the same cause.

That the hæmorrhage in such cases as we are considering comes from the congested vessels of the kidney, and is not due to cancer, calculus, tubercle, etc., the history of the case, and the mode of onset of the bleeding, will, in most instances, clearly show. There will be an absence of any previous renal symptoms, the presence of retention, and then the hæmorrhage after the tension caused by the pent-up urine has been removed.

Prognosis.—The prognosis must always be serious in old men with prostatic trouble, or in young men who have a hæmorrhagic tendency. In the former, especially, pyelitis is liable to be set up, and run on to pyelo-nephritis. This is the more likely, as in these cases chronic interstitial nephritis, with

dilatation, most probably exists. Cystitis is also a serious danger, and may be very troublesome, especially if clots form, and are allowed to give much trouble. The severity of the bleeding may be a source of great peril in enfeebled subjects.

Pathology.—It has been already stated that hæmorrhage is the result of congestion, and that it is attended with the rupture of some of the vessels of the mucous membrane. It is, however, quite possible that the extent of giving way of vessels is very slight, and that the hæmorrhage may be chiefly in the form of an *exhalation*. That extravasation actually occurs is seen from time to time on the post-mortem table, by the hæmorrhagic areas of the mucous membrane of the pelvis and calyces of the kidney. These are seen on the bladder mucous membrane as well as in the renal pelvis, and they are by no means unfrequent in cases in which blood in small quantities has been passed with the urine, as well as in the cases under notice, in which a considerable discharge of blood results from catheterism. A very similar form of hæmorrhage is seen from time to time in hydrocele. A large hydrocele is tapped, and clear fluid is drawn off; subsequently brownish opaque fluid is withdrawn, or the hydrocele, perhaps, is rapidly replaced by a hæmatocele. What has happened is the sudden removal of counter-pressure from the sides of the blood-vessels, some of which are varicose, and burst (Percival Pott).

Treatment.—To prevent the occurrence of hæmorrhage, great care should be taken before the first catheterisation. The precautions mentioned in the account of the treatment of urinary fever should be followed. The catheter should never be used, at least on a first occasion, upon a person while standing; on the contrary, he should be recumbent upon his own couch, or better still, in his bed; nor should the

urine be too rapidly drawn off. To avoid this latter danger, a medium-sized catheter (No. 6 or 7 is quite large enough) should be used; and no effort should be made, either on the part of the surgeon or the patient, to expel the urine. Neither coughing nor straining by the patient, nor hypogastric pressure with the hand of the surgeon, should be permitted; but the urine should flow simply by the contractile power of the bladder and the natural compression of the walls of the bladder by the surrounding viscera. It will be better not to tie any instrument in the bladder, but to re-introduce it from time to time, provided always this can be done gently and easily, as well as regularly.

If these conditions cannot be fulfilled it will be best to tie the catheter in and plug it, leaving the patient or nurse to remove the plug and let the water off at stated times.

When hæmorrhage has commenced, no effort should be made to check it by applying ice externally; nothing should be done which is calculated to cause increased renal congestion, and cold to the surface of the body would have this effect.

It must be borne in mind that there is a great tendency for pyelitis and pyelo-nephritis to follow the congestion, of which the hæmaturia is a sign; therefore warmth and rest in the horizontal position, and restricted simple or milk diet, are indicated. Ergot of rye is the most useful of drugs, given in ʒj doses of the liquid every four hours for three or four doses, and continued in ʒss doses at longer intervals until the bleeding shows indication of ceasing. Gallic acid, in doses of ten to fifteen grains, given in mucilage every two or three hours, is also of value. Tincture of the sesquichloride of iron in doses of twenty minims, in syrup of lemons or ginger and a bitter infusion, is an excellent remedy.

Opium is also of service, and may be combined with the gallic acid mixture; it quiets the nervous system, steadies the action of the heart, and acts as a tonic to the circulation.

If clots accumulate in the bladder they must be removed through a large-eyed or double-action catheter, and the bladder should be washed out with warm or tepid water. If there is any difficulty in getting rid of the clots by washing, and especially if their presence has excited much spasm or irritability of the bladder, external urethrotomy, or lateral cystotomy, should be performed at once, and the bladder freely drained.

Belladonna or morphia suppositories will assist in quieting the bladder. The rectum should be kept emptied by the use of enemata.

CHAPTER XXVIII.

RENAL DISEASE A CAUSE OF IRRITABILITY OF THE BLADDER—DISEASES OF THE KIDNEY WHICH SIMULATE DISEASE OF THE BLADDER—RENAL DISEASE A PROBABLE CAUSE OF PROSTATIC ENLARGEMENT.

IT is a fact which ought never to be forgotten by the surgeon, that frequent micturition, and pain, spasm, and irritability of the bladder and urethra very frequently depend on intestinal and other remote irritation, and are quite independent of stone, stricture, inflammation, or, indeed, any affection of the urinary organs themselves.

If this were a monograph on the affections of the lower urinary organs, I should refer to cases in which functional disorders of the stomach and intestines,

but more especially of the colon and rectum, had caused such severe bladder or urethral symptoms as to give rise to the impression that the bladder or urethra was the seat of organic disease. But I must content myself by referring the reader to Sir Charles Bell's "Treatise on Disease of the Urethra, Vesica Urinaria, Prostate, and Rectum," in which he will find reported several such cases.

We must here limit our consideration of bladder symptoms due to remote irritation to cases in which the kidney is the disturbing cause.

In the preceding sections we have considered the diseases of the kidney which are secondary to diseases of the bladder. But more might be said in support of the doctrine that the kidney and bladder excite reciprocal influence on each other. Not only do hydro-nephrosis, pyo-nephrosis, acute interstitial nephritis and suppurative pyelo-nephritis result from stricture of the urethra, enlarged prostate, and the numerous other causes of chronic cystitis and renal obstruction; but (and this is what we have now to consider) *various functional and organic affections of the kidney give rise to functional and organic changes in the bladder.*

Some of the severest forms of bladder suffering, and of frequency of micturition, occur in cases of renal disease, where there is no organic disease whatever in the bladder; and I point to scrofulous kidney especially in proof of the truth of this assertion. Moreover, it not unfrequently occurs that the surgeon is asked to examine the bladder of patients suspected to be suffering from vesical calculus or growth, but whose disease is limited to their kidneys.

I might quote several authorities and cases to justify me in stating the following dogma: "Various functional disturbances and organic diseases of the kidneys are attended with so little, if any, pain referred to those

organs, but with so much pain and irritation in the bladder and urethra, that the bladder or urethra, and not the kidneys, are considered to be the parts affected." To this I may add that "in some cases, in which the symptoms excited by renal disease are all referred to the bladder and urethra, no organic lesion is found in the lower urinary organs even after prolonged illness; that in other cases secondary organic lesions are produced in the bladder; and, lastly, that in some calculous and other diseases of the bladder most serious and extensive lesions may be present in the kidneys, although pain in the loins is not complained of, and the only malady indicated by the symptoms is referable to the bladder."

The last fact referred to in the foregoing statement is by no means an uncommon one; and hence it happens that the most able and careful surgeons, before undertaking lithotomy, lithotrity, the removal of vesical tumours, or any other operation upon the bladder or urethra, having examined attentively the kidneys without detecting anything which has led them to infer disease of those organs, have nevertheless seen their operation followed by a sudden rigor, then high fever and death; and, on post-mortem examination, not only has pus or a calculus been found in the pelvis of the kidney, but the renal substance has been inflamed or even in a state of suppuration. These latent states of pyelitis and pyelo-nephritis are observed also in cases of cancer and other organic lesions of the bladder, prostate, and urethra, as has been fully stated in previous chapters.

I will now endeavour to summarise the facts which are to be learnt from a study of the cases in which irritability and pain of the bladder and urethra have their real seat and cause in the kidney.

1. The nature of the renal affection.—This may be either functional or organic. *Functional*

derangements affect the bladder through the unnatural properties of the urine. Healthy urine is a natural stimulus to the renal and bladder mucous membrane, but unhealthy urine is a source of irritation to it; and owing to the more abundant nerve supply of the bladder and to the greater admixture of spinal nerves in that supply, the greatest effect of this irritation is experienced in the bladder and along the urethra. Whether the urine be unduly acid or alkaline, or exceedingly diluted and abundant, or too concentrated and scanty, the bladder is liable to become and remain irritable, and the seat of pain, until the healthy character of the urine is restored. Often the fault, though apparently in the kidneys, is really in the assimilating and digestive organs; and hence the reason why persons who are dyspeptic and those who are indiscreet in their diet suffer most from irritability of the bladder. Such is the explanation of some of the cases of pain and irritability felt in the bladder referred to by Sir C. Bell as proceeding from "disorder of the bowels;" and notably one in which these symptoms were produced by "a preposterous indulgence in figs and Spanish white wine at supper."

There are several *organic* diseases of the kidney accountable for bladder trouble. Renal calculus, scrofulous kidney, cystic disease, pyelitis, inflammation of the capsule of the kidney, renal abscess, perinephric abscess, displaced kidney, cancer, hydatid, and Bright's disease are the conditions which have been found, when, on post-mortem examination, the bladder was either quite unaffected or only secondarily the seat of organic change.

2. **The manner in which the bladder becomes affected.**—This may be through reflex irritation, due to causes of irritation seated in the kidney or ureter; or to extension of irritation and

inflammation by direct continuity along the ureters, which being most sensitive at their lower ends are prone to be most severely affected there. In cases of pyelitis and scrofulous disease the bladder is not unfrequently invaded in this manner; and sometimes the inspection after death gives the idea that the disease has travelled across the bladder from one ureter to the other, and in this way spread down from one kidney and up along the ureter to the opposite one. A third way in which the bladder is affected is by the transit of calculous matter, or small calculi, or acrid or muco-purulent urine from the inflamed or suppurating kidneys.

When affections of the bladder originate in renal disease, the orifice of the ureter on the side affected and the neck of the bladder are the parts most frequently and earliest involved; the orifice of the ureter is generally affected first. Prout thought this was explained by the fact that the orifice of the ureter is constantly exposed to the contact of the unnatural urine as it passes into the bladder, and the neck of the bladder is the part towards which by the position of the body the urine gravitates.

3. **The symptoms excited.**—These are usually such as are attributed to stone in the bladder or to stricture of the urethra, namely, pain, spasm, and irritation at the neck of the bladder; a lancinating pain, or a sensation of burning pain along the urethra and at the end of the penis during and after micturition; and a frequent call to pass water, occasionally amounting to actual incontinence. Sometimes a pain is referred to the perinæum, and the patient dreads to bring his thighs together; and yet firm pressure does not excite the pain, showing that it is but a transferred sensation and not a pain actually originating there. Sometimes the hypogastrium, the groins, and one or both testicles are the seat of pain

or aching. I have known the testicle to suppurate in a case of renal calculus disease in which all the symptoms were vesical.

The intervals between micturition vary greatly from a few minutes to an hour or two. I have before me the notes of a patient, a detective officer, who himself kept the record of the number of times a day he passed urine; and for several days in succession the average number was 160 times. This poor fellow suffered more from pain and frequent micturition than any other person I have known; his disease was scrofulous kidney, and though at the last the bladder and prostate were invaded, yet it was to the bladder, and never to the kidney, that his symptoms were referred at the first as well as throughout his illness.

In another case the man was passing urine four, five, and even six times an hour, and so great was his distress in consequence that I opened his urethra from the perinæum, and having explored his bladder, tied in a drain tube through the wound; during the rest of his life (several weeks) he voided all his urine through the opening in the perinæum, and was entirely deprived thereby of his bladder suffering. He died after becoming anasarcous about his legs and face; the bladder was found to have thickened walls, but not to be otherwise diseased; his kidneys were the seat of chronic Bright's disease, and fatty.

The introduction of a catheter or sound yields a negative result; nothing will be found either in the urethra or bladder to explain the symptoms.

The urine varies much, according to the nature of the renal affection. Sometimes oxalate of lime or lithic acid and lithates of ammonia are found in the urine; sometimes the urine is excessively acid, at others alkaline, and depositing crystals of the triple phosphate of ammonia and magnesia. When pyelitis exists from any cause, there will be

more or less pus in the urine; when cancer or calculus is present, blood may be passed. Dr. Prout says that in the form of strumous disease, which he specially describes as being a frequent cause of bladder irritability in early and middle life, "the urine is generally acid; of a pale-greenish, whey-like colour; opalescent, from the presence of minute flocculi, or particles of diseased epithelium or mucus, of low specific gravity, often serous, but rarely bloody. Sometimes, on being heated, it deposits the phosphates; but the lithate of ammonia is seldom so abundant as to be spontaneously separated on the cooling of the urine. . . After standing for some time, the urine becomes clearer, but seldom acquires perfect transparency, even by filtering; and the peculiar sediment in general is very easily remixed on shaking." A case of scrofulous disease of the kidneys, which was regarded by the medical attendant, and sounded by Mr. Stanley, as a case of disease of the bladder, was correctly diagnosed by Dr. Prout from the characters of the urine.*

In cases in which there is no suspicion of cystitis, and in which neither pus nor blood is passed off in the urine, the urine may be quite clear, and without any deposit whatever; but it may contain the serous elements of the blood for all that, and morbus Brightii is then the cause of the irritability of the bladder. The urine should therefore be always examined for albumen, and as to its specific gravity, in cases in which there is neither blood nor pus nor mucus.

4. The **diagnosis** can only be made after careful and repeated examination of the urine, and an examination of the bladder and the urethra. Error in diagnosis (so easy unless it be always borne in mind that severe bladder symptoms do not necessarily

* *Lond. Med. Gazette*, vol. xxiv., p. 563.

indicate bladder disease) will be avoided by sounding the bladder, examining the prostate with the finger in the rectum, and by enquiries as to the state of the digestive organs, as to pain in the loins, and as to the chemical and microscopical composition of the urine. When pus and muco-pus are present in the urine, the first thing to decide is whether there is or is not cystitis. When blood is present, see whether it does or does not come from the prostate or bladder; if it does, it will be almost invariably increased by sounding, whereas if it comes from the kidney, the introduction of an instrument does not aggravate the bleeding. When the urine is clear, always search for albumen, and take the specific gravity of the mixed urine (not the fasting urine only) for several days in succession, as well as the total amount voided during each day. By these means the bladder, urethra, and prostate will be excluded, and the diagnosis will be reduced to a functional or organic disease of the kidney. This latter point is the most important in the enquiry. In the functional cases the symptoms will subside on the correction or removal of the cause of the derangement, and there will be an absence of the more serious changes in the urine; pus, blood, albumen, and casts will not occur, though oxalate of lime, lithates, or phosphates may for a time abound.

Prognosis and treatment.—The prognosis, like the treatment, must necessarily depend upon the cause. In organic disease of the kidney the prognosis is always grave; and in many cases, especially of scrofulous and cancerous disease and of the very advanced stages of calculous pyelitis and Bright's disease, there must be a quickly fatal termination. In functional disease the prognosis is good, the symptoms soon disappearing if the abnormal condition of the urine is corrected, whether by attention to the regular action of the bowels, or by an alteration in diet, or by

the administration of suitable drugs. In persons who have once suffered in this way, there is a tendency to relapses on future similar provocation; and when the symptoms return there is the same tendency for the patient to dread that they are due to some serious cause; most frequently stone or stricture are apprehended. The surgeon having satisfied himself that there is no stone or growth in the bladder, and no stricture in the urethra, should lay aside instruments, and address himself to the medicinal and general management of the case, and to acquiring that implicit confidence of the patient which is necessary before the latter can dispel his fears.

In exceptional cases of incurable organic disease, when there is great frequency of micturition, perhaps even a continuous incontinence of urine, and much pain and spasm of the bladder, the urine should be allowed to drain away through a perineal incision, made either in the median line or as in lateral lithotomy. The former is much less risky, but lateral cystotomy may give more complete rest to the bladder. I have found the median incision, however, sufficient.

Nephro-lithotomy, nephrotomy, and nephrectomy are indicated in certain cases of calculus, abscess, and scrofulous kidney. I have performed nephrotomy with the best result in a case of renal abscess in which all the symptoms were referred to the bladder.

RENAL DISEASE A PROBABLE CAUSE OF PROSTATIC ENLARGEMENT.

We have seen that renal disease is a not unfrequent cause of irritability of the bladder. The seat of the irritability is the mucous membrane of the trigone. Here the inner surface of the bladder is endowed with exquisite sensibility; and this sensibility it is which produces the natural call to pass water both in health and disease. When this sensibility is increased by

disease, and excites repeated acts of micturition, and constant spasm of the muscular coats of the bladder, the prostate gland is subjected to unusual irritation.

Whatever excites the bladder to frequent contractions disposes to hypertrophy of the muscular tissue of the bladder. By their repeated contraction these fibres exercise an almost continual drag upon the prostate gland.

It is not unlikely that renal disease, changes in the character of the urine, and every other cause of irritability of bladder in elderly men, have thus a tendency to promote growth of the prostate, and thus produce retention of urine from prostatic hypertrophy.

Herein we have an additional reason for correcting vesical irritation in middle and advanced age, as quickly and as effectively as possible.

Literature.

Morgagni: "The Seats and Causes of Diseases," letter xlii., pp. 2 to 5.
"Sepulchretum," lib. iii., sect. xxv. xxvii., obser. 10.
Sir Charles Bell: "Institutes of Surgery," and "Treatise on Diseases of the Urethra," etc.
Dr. Prout: "On Stomach and Renal Diseases," p. 366, 4th ed.
Dr. Owen Rees: *Lancet*, vol. i., pp. 445, 469, 495, 547; 1857.
M. Rayer: "Traité des Maladies des Reins," vol. iii., pp. 92, 93.
Sir Benj. Brodie: "On the Urinary Organs," 3rd edition.
Mr. Coulson: "On Diseases of the Bladder," 4th edition; 1852.
Dr. H. J. Johnson: *Medico.-Chirurg. Review;* 1835 and 1836.
Dr. Coupland's "Dictionary of Medicine," vol. ii., p. 662.
Memoirs of Med. Soc. of London, vol. i., obser. 24.
Howship's "Practical Treatise, etc., on some of the most important complaints that affect the secretion and the excretion of urine," p. 40.
Samuel Cooper: "Surgery Dictionary." Dr. Christison.
Mr. Cheston: "Pathological Inquiries and Observations in Surgery." 1766.
Mr. Bryant: "The Practice of Surgery;" and Mr. Erichsen: "Science and Art of Surgery." } See their enumeration of the causes of "irritable bladder."

CHAPTER XXIX.

RENAL CALCULUS.

In this chapter I shall give a description of the symptoms, diagnosis, and surgical treatment of renal calculus, referring only briefly to the medicinal and dietetic treatment and to the pathological effects of calculus.

General remarks.—There is but a step between the formation of gravel and of stone in the kidney. If the solid substances, which are usually in a state of solution in the urine, become excessive, so as to be deposited as crystals, and if these crystals are carried out of the system with the urine, we have the condition of gravel. If these crystalline forms are cemented together by a little mucus or blood clot, and are afterwards added to by fresh depositions from the urine, we have a small calculus, which may either be passed off with the urine, causing more or less renal colic in its transit along the ureter, or may remain behind in one of the calyces or in the pelvis of the kidney, there to grow by fresh accretion until it attains a size altogether in excess of anything which can pass along the ureter.

Calculi may originate in the uriniferous tubes or in one of the calyces of the kidney; but when started into being in the tubes, the calculus grows into importance in a calyx or in the pelvis of the kidney.

The most common form of renal calculus is the uric acid, the next most common is the oxalate of lime. These substances, being but very sparingly soluble, are the most likely to be precipitated from the urine; but carbonate of lime, phosphate of lime,

a mixture of phosphate and the ammonio-magnesian phosphate (that is, the fusible calculus), cystine, xanthine, and finally urate of ammonia, or the mixed urates, are found occasionally, though rarely, either as the nucleus or chief constituent of renal stones. Alternating calculi of uric acid, oxalate of lime, and phosphates in distinct layers are not uncommon. Blood calculi have been described, and a drop of dried blood is occasionally found as the nucleus of a mixed calculus. Dr. Scott Allison recorded a case of phthisis, in which, after death, several black concretions, varying in size from a coriander seed to a horse-bean, and composed of blood of firm consistence, were found in the kidney. I have seen such concretions in the pelvis of a kidney in which a mixed calculus of uric acid and phosphates also existed. Dr. Curnow* has recorded a case of multiple oxalate of lime calculi in each kidney, the nuclei of which were blood clots.

Renal calculi are formed at all periods of life, from the latter weeks of intra-uterine existence up to quite old age. It is, however, before the age of fifteen and after the age of fifty that calculous affections chiefly occur. In the poorer classes the preponderance of patients are children; in the better classes they are chiefly persons past middle life. Stone in the children of the well-to-do is very rare; its prevalence amongst the poorer is probably due, as Mr. Cadge explains, to the absence of milk in their diet.

Mr. Thomas Taylor, to whom the College of Surgeons is indebted for analyses of the calculi in the Hunterian Museum, tells me that the nucleus of renal calculi formed in *infancy* is urate of ammonia, and in the College Catalogue he proposed to call a calculus with this sort of nucleus the infantile calculus; that the nucleus of calculi formed in *young*

* Path. Soc. Trans., vol. xxiv., p. 148.

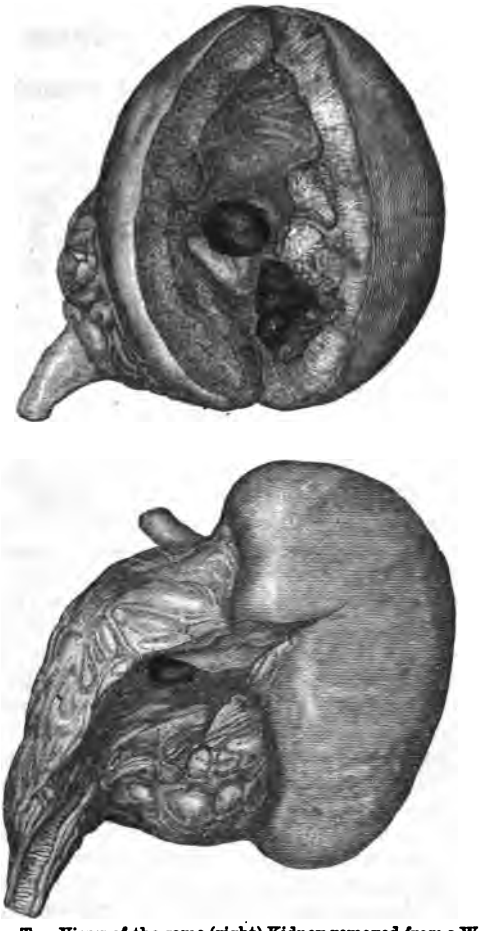

Fig. 34.—Two Views of the same (right) Kidney removed from a Woman who died of Cirrhosis of the Liver. (Middlesex Hospital Museum, No. 1795.)

A sarcomatous tumour, the size of a fist, is attached to the hilum and completely surrounds the pelvis and commencement of the ureter. The pelvis of the kidney is dilated, and contains two rough, dark calculi, one of which is spherical and the other branched.

adult life is uric acid; whereas that of calculi formed after the fortieth year is oxalate of lime.

One or both kidneys may be affected at the same time, or one may become so subsequently to the other. When due to a local cause such as injury, or a sarcomatous (Fig. 34), or papillomatous growth in the kidney, only the affected organ is the seat of stone.

One or many calculi may be formed in the same kidney, so that even scores have been found scattered through the organ. When the calculus is composed of oxalate of lime, it is generally single; when of uric acid it is often single, but it is far less likely to be so than when of oxalate of lime.

In size and shape there is the greatest possible variety, from a small, round, smooth body to a large, rough, and branched mass filling all the pelvis and calyces. Much depends upon the size of the stone, and also on its position in the kidney, as to the amount of damage wrought by its presence upon the renal structure. A stone as large as a marble, rough and sharply mammillated upon its surface, may remain confined to one of the calyces for years without giving rise to more change than induration of the whole organ, due to slight chronic interstitial inflammation. On the other hand, quite a minute stone, not much, if any, larger than a mustard or grape seed, whilst in the tubular structure of the kidney will excite congestion and even acute inflammation and abscess.

When a stone is of such large size that it fills the renal pelvis, or when, being much smaller, it falls like a ball-valve into the upper end of the ureter, it leads to chronic inflammation, to dilatation, and to those atrophic changes which accompany hydro-nephrosis and pyo-nephrosis; or nephritis, pyelo-nephritis, abscess in the perinephric tissues, or profuse suppuration within the kidney may be the result.

Symptoms.—A small stone may develop, travel,

and escape without giving rise to any symptom. A stone of moderate or even large size may exist for

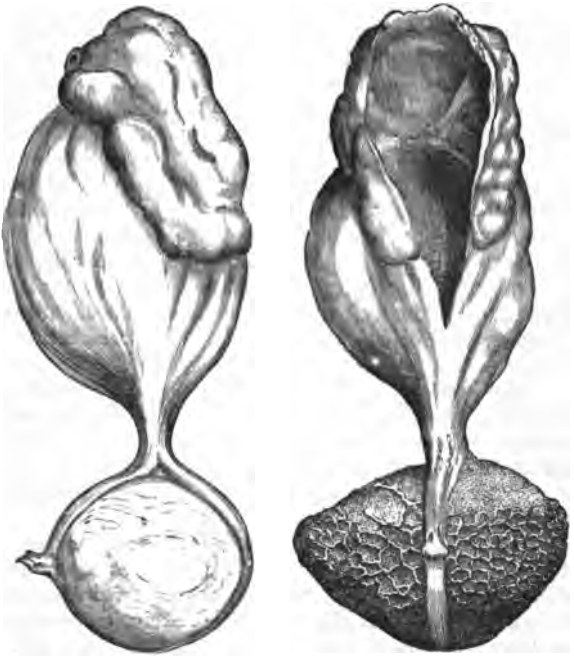

Fig. 35.—Two Views of the Pelvis of a Right Kidney expanded into a Sac considerably larger than a Turkey's Egg. (St. George's Hospital Museum, No. 3911; 53B.)

The kidney is reduced in size and conspicuously lobulated. The calyces dilated. An oxalate of lime calculus weighing 7¼ ounces occupied the pelvis, and is represented in the figure as slung in the ureter. The ureter was healthy. The renal pelvis was tightly stretched over the calculus, but it would seem that the unevenness of the surface of the stone allowed the passage of urine.

years without causing any noticeable symptoms; and having been uncomplained of during life, may be met

with as a surprise when the body is examined after death.

As a rule, no doubt, there is at some time blood or albumen mixed with the urine; some lumbar pain or aching, aggravated by exercise or by any jarring or jolting movement; some vesical irritability; perhaps some pain in the testicle of the same side. If the stone has existed a long while, pus, mucus, or albumen will be found daily in a minute or moderate or marked quantity in the urine; or if blood is not invariably present (and in many cases it is not), it may occur from time to time in large amount, making the water bright red or porter-like in colour for several days together. If with these symptoms the patient occasionally passes gravel or minute calculi or fragments of calculous matter, the diagnosis becomes conclusive.

Movements, such as those caused by carriage exercise, running, or walking, are not in all cases needed to cause exacerbation of the lumbar pain; on merely turning in bed, or even when lying asleep, the patient may be aroused by a sudden agonising seizure.

It would thus seem that the varying pressure of the abdominal viscera, the passage of fæces along the colon, the variations in the degree of intrarenal blood pressure, are all capable of exciting pain by making the renal tissue press against the, often acicular, surface of the calculus.

A calculus traverses the ureter partly by the weight of the accumulating urine behind, partly by the vermicular contraction of the muscular coat of the ureter, aided too, perhaps, by the retching and vomiting which its transit excites. As soon as a stone enters the ureter, or is being propelled along it, stretching it as it goes, renal colic sets in. The attacks of renal colic come on suddenly, last for two or three

hours or as many days, and almost as suddenly subside, to recur at some future period, if the stone, instead of escaping at the lower end of the ureter, is simply displaced from the upper orifice into some less important point in the renal pelvis. Recurring attacks of colic arise from fresh formation of renal calculus. I had a gentleman under observation some time ago who had had three distinct and severe attacks of colic; each lasted about three days, and came on at almost time-regulated intervals of six months. From thirty-six to forty-eight hours after each attack a small, irregularly rounded, smooth-surfaced calculus was voided with the urine. He was placed upon a regulated diet, and ordered soda-water with bicarbonate of soda added to it as a daily drink, and he has had no attack since, now more than two years.

Sometimes a fragment of a larger calculus passing along the ureter excites renal colic, and complete relief does not follow its discharge from the body; or a small calculus in its transit causes the colic, and a second or third calculus remains behind to still trouble the patient.

Thus, in 1873 a man, aged 28, was under my care with symptoms of renal calculus. In June he passed a stone the size of a hemp seed, and in August another the size of a pea. An attack of colic preceded the discharge of each calculus, but no decided relief was obtained until after the escape in November of an irregularly cylindrical calculus an inch long. From this date he was quite well till January 9th, 1874, when stiffness and slight pain in the left loin were felt. Under alkaline treatment, restriction as to the quantity of beer, and an otherwise regulated diet, these symptoms disappeared.

Periodic attacks of renal colic occur in some cases without being followed by the discharge of a calculus, or fragment of a calculus. They are then due to

the irritation of a calculus in the pelvis or one of the calyces of the kidney under the influence of movement of a jolting or shaking character, such as running, dancing, riding in a carriage, or travelling by steamboat; or to the passage of a lump of mucus or blood clot along the ureter. They will also come on without any ascertainable cause, especially when the patient falls into low health or is worn out by prolonged or fatiguing occupation.

During these attacks the pain shoots down the course of the branches of the lumbar plexus, and is felt in the bladder, in the groin, along the thigh, or in the testicle. The pain is paroxysmal, and intensified by the spasmodic contractions of the ureter. The testicle may be retracted at the time, and afterwards become enlarged and remain for a long while tender, if not painful. I have seen the testis of the affected side small and wasted as well as retracted. Women have aborted, men have committed suicide, and both men and women have been thrown into convulsions during the fearful agony of renal colic. The attack is often ushered in with a rigor, and is generally accompanied by vomiting, retching, and profuse perspiration. Faintness and collapse are by no means rare. The bladder is irritable, and the urine, which is diminished in quantity during the attack, is blood-stained and loaded with urates, and is sometimes passed with a good deal of scalding in the urethra. It sometimes happens that the other kidney becomes excited to increased secretion during the attack, and then the urine will not be diminished in quantity, and will not be thick.

When the patient is very thin, and the stone large, it can sometimes be detected on palpation of the loin. Howship speaks of a patient who used to feel the stones in her kidney grating together on movement. Mr. Pick has published in the *Lancet*

a case in which he made the calculi grate upon each other by pressure with his hands placed on the loin and front of the abdomen; similar cases are on record.

Apart from the attacks of renal colic, lumbar and renal pain is a very common symptom of a stone in the kidney. A small calculus may give rise to such a localised sensation as to create in the mind of the patient a clear impression of the size and outline of the offending body.

Owing to the wide nerve connections of the kidney, the pain of renal calculus is often transferred to a distance, *e.g.* to the testes along the spermatic plexus and the genito-crural nerve; to the upper part of the thigh by the genito-crural; to the leg and inside of the foot through the anterior crural. Dickinson and Ralfe each speak of cases of pain in the sole of the foot. One patient had the sensation "as if the sole were raw, and being rubbed with scouring paper." In another the pain was, continuously, in one of the heels, the sole of the foot, or more rarely in the outer edge of the foot. Pains in the sole and outer side of the foot are less directly explained.

It is important to know, with a view to surgical treatment, whether one or both kidneys are the seat of stone. There is usually not much difficulty in this, unless, of course, a stone is lying dormant in one kidney whilst symptoms are excited by that in the other; but it is necessary to bear in mind that a stone in one kidney will sometimes excite sympathetic pain and irritation in the other. This transferred or sympathetic pain is of an aching character, not of a spasmodic or colicky description.

Paroxysmal, lumbar, and sciatic pains, accompanied or not by retching, are by no means rare. Sometimes the sciatica is severe enough to keep the sufferer within doors for some time together; and though the pain will be on the side of the calculous

kidney, there may be nothing to indicate the cause of the pain. In all such cases it is prudent to institute a careful examination of the urine as to the presence in it of blood, albumen, or crystals; and a careful review of the clinical history especially as to previous attacks of hæmaturia. At the same time it must be remembered that uric acid in excess and oxalic acid in the urine are often attended by hæmaturia, crystals in the urine, and wandering, transferred, and paroxysmal pains in the back, thigh, calf of leg, and sole of foot.

Prout states, and Dickinson agrees with him, that uric acid calculus produces the least pain, and that of a dull oppressive character with a sense of weight; oxalate of lime causes a more acute kind of pain referred to a particular spot, as well as shooting to the ureter, shoulder, or epigastrium; and phosphates give rise to great and unremitting pain attended, however, with exacerbations.

Another symptom which results from transference of nerve influence has reference to the stomach: nausea, vomiting, and dyspepsia are very common, not only at the times of actual colic, but during the periods of less acute suffering. These symptoms are explained through the connection of the pneumogastric with the renal plexus. The retraction of the testicle, irritability of the bladder, pain referred to the thorax and sometimes thought to be due to pleurisy, are all explained in the same manner as the gastric disturbance and the pains in the lower limb, namely, by transference of nerve influence.

As is the pain, so are the other common symptoms of renal calculus largely due to the actual contact of the stone with the mucous membrane of the kidney or ureter. These other symptoms are hæmaturia, pus in the urine from inflammation of the pelvis of the kidney, and the occasional sense of fulness or

puffiness caused by the mechanical obstruction to the outflow of urine.

The hæmaturia is not often profuse or constant. Sometimes it is sufficient to give a coloured deposit on standing, at others it needs a microscope for its detection. It is not proportionate to the size or number, nor dependent on the chemical nature of the stones, except in so far as the oxalate have generally the roughest surface, and are therefore the most irritating. It is not intimately related to pain or to any of the other symptoms. In some cases it stands alone, in others it is associated with some of or all the other common indications of stone. When there is a tendency to hæmaturia it is generally increased on moving about. In a young woman from whose kidney I removed a stone weighing 33 grains, hæmaturia was a very prominent symptom, and like the pain, which also was severe, it was aggravated by walking and standing about; but it rapidly disappeared by resting entirely in bed.

Pus in the urine is a consequence of inflammation of the mucous membrane of the pelvis and calyces of the kidney. Sometimes, as the first sign of pyelitis, before pus corpuscles are seen, the microscope reveals granular corpuscles and epithelial cells or scales mixed in fibrous threads of mucus, as well as a few blood corpuscles. Mucus and the fibrous threads of mucus occur more frequently when the calculus is of oxalate of lime. The pus of pyelitis occurs in acid urine, is not stringy, and separates readily from the urine on standing. The urine is not offensive. When the urine, as it is in exceptional cases, is rendered offensive by having undergone decomposition in the pelvis of the kidney, the destruction of the kidney is considerable, and the health of the patient materially affected.

Tenderness over the affected kidney will often be

complained of by pressing on the loin or over the front surface of the organ. The peculiar attitude and gait of a patient with a renal calculus are due to an effort to relax as much as possible all pressure on the kidney. Thus, as in perinephric abscess, hydronephrosis, and other renal affections, lateral inclination and flexion of the thigh are usual.

Diagnosis.—There are many difficulties in the way of diagnosis. There is a great resemblance in the symptoms of renal calculus and of acid urine. There is no more certain cause of pain in the loins, of frequent micturition, and even of a slight amount of pus or blood in the urine, than very acid urine, and urine overcharged with uric acid.

The acidity of the secretion, or the crystals of uric acid, by irritating or inflaming the mucous membrane of the kidneys, cause albuminuria, slight hæmaturia, or the admixture of pus with the urine; and this may go on for months or a year or two without causing any actual or permanent degeneration of the renal tissues. The patients who are prone to these conditions are often of a gouty diathesis; suffer much, occasionally, from irritability of the bladder; frequently get a good deal of feverishness, and, though they do not experience acute pain in the testicle, they will sometimes complain of marked testicular tenderness on pressure.

The diagnosis in such cases will be cleared up by the improvement which follows upon alkaline treatment. The citrate or tartrate of potash or soda, given every four hours during the day, neutralises the acidity of the urine as it is secreted, and thus the cause of the symptoms, and with it the symptoms themselves, disappear. Moreover, these alkaline salts, by producing a supercarbonate of the alkali in the urine, dissolve the uric acid and the earthy phosphates, and thus not only tend to prevent the formation of

urinary calculi, but, by diminishing their size, facilitate the expulsion of any small concretions, if so be that such have already formed, and are adherent or otherwise retained.

Where there is a persistent tendency to the formation of uric acid calculi the symptoms again and again recur, so that the continuance or repetition of the alkaline treatment is necessary; and as it promotes the descent and discharge of the calculi, the patients are apt to condemn the remedy as being the cause of their trouble, instead of honouring it as the means of their deliverance.

Hæmaturia is looked upon as almost a necessary result of calculus; and probably it would not be far wrong to say that hæmorrhage from the kidney is in a majority of cases caused by renal calculus.

It must, however, be borne in mind that, besides resulting from various other renal affections, non-malignant as well as malignant, renal hæmorrhage sometimes occurs when there is no ascertainable cause for it, from a mere relaxation of the blood-vessels, or from simple increase of intrarenal blood pressure. If such hæmaturia occurs in a rheumatic or highly nervous or hysterical person, the symptoms of renal calculus may be very perfectly simulated.

On the other hand, a stone in the kidney may not cause hæmaturia at all, or not during the time the patient is under observation. If the quantity of blood passed has been slight, its presence may never have been observed by the patient; and if the hæmaturia is intermittent, the most careful examinations, extending over many weeks or months, may not discover it.

The clinical history as to hæmaturia is, however, all important, and will sometimes help to save us from errors of importance. Dr. Owen Rees records how a young lady of marked hysterical disposition had

lumbar pain and frequency of micturition set down to hysteria, and treated accordingly; until, at length, due attention to the clinical history revealed that hæmaturia had existed on more than one occasion. A mulberry calculus was ultimately found in her kidney.

Frequency of micturition is also a symptom which requires great attention. It is the offspring of many causes, renal, ureteral, vesical, prostatic, and urethral, but it is a very common symptom of renal calculus. In some cases the irritation at the neck of the bladder is so excessive that the thought of a calculus in the kidney or ureter does not arise; but catheters and sounds are again and again resorted to on the supposition that the seat of disease is the urethra or bladder. If the frequency of micturition be associated with pus in the urine, cystitis is, perhaps, said to exist; whilst in reality the pus is coming from the higher urinary passages, and any cystitis which is present is the direct result of the so-called "exhaustive examinations" of the bladder with instruments.

I have known a case in which, for many months, the patient was looked upon by eminent men as suffering from subacute cystitis; but the pus in his urine came from the kidney, and in the end he died of a large abscess extending into the perinephric tissue.

Dr. Dickinson relates that "a young woman died under his care in St. George's Hospital with symptoms of pyelitis, which might have been the result of either stone or tubercle; but her distress was almost wholly vesical; the urine, which was persistently purulent, was passed with much frequency, pain, and difficulty, and the catheter was often needed. Both kidneys were occupied by large rough stones, the bladder and urethra were perfectly natural, the vesical trouble wholly of renal origin, no doubt in part due to the irritation of the purulent and alkaline urine."

Whilst a calculus is hollowing out a nest for itself

PLATE IV.

Fig. 1.—Calculus (89½ grs.) removed by nephro-lithotomy from a young man.

Fig. 2.—Kidney with calculus *in situ*, removed by lumbar nephrectomy.

Plate IV

Fig 1.

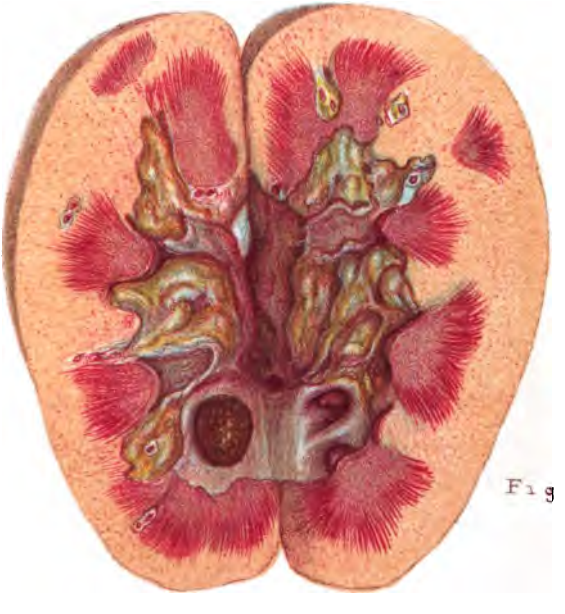

Fig 2

in the kidney, or is growing in a calyx or the renal pelvis, a slight degree of pyelitis goes on and causes purulent urine, and often irritability of the bladder. When this *encysting process* is completed and the calculus is comfortably lodged, the pus disappears from the urine, and the frequency of micturition subsides. The length of time this process lasts is very uncertain, and varies from a few weeks to a year or two, or more. If it be not too prolonged, and the sufferer be healthy, perfect convalescence may follow; but if the process be very prolonged, or the patient be strumous, aged, or weakly, renal abscess, pyelo-nephritis, or perinephric abscess, and death, result. A correct diagnosis may generally be made in cases of frequency of micturition if, besides small quantities of pus, there be also, from time to time, a little blood in the urine, and more or less constant paroxysmal pain in the lumbar region and in the groin or testicle. When the lumbar or testicular pain is absent, frequency of micturition, with purulent and blood-mixed urine, is insufficient for a correct diagnosis; and, even though renal calculus be the cause, there are no data for selecting one kidney rather than another for lumbar exploration. But should we, under these circumstances, be ever justified in examining both kidneys from within the abdomen? I think we should, if the patient be clearly going into a bad way; more especially if there have been, at any time, marked crystalline forms in the urine, and if a digital examination of the vesical ends of the ureters give a negative result.

Probably *the greatest difficulty in diagnosis is between early strumous kidney and renal calculus.* The symptoms are at first almost identical, and the disease has often made great progress before its strumous character is apparent.

When frequency of micturition and slightly purulent urine are met with in a person of strumous habit,

and are unaccompanied by history of hæmaturia, the strumous nature of the disease is fairly clear; but when they are associated with a history of hæmaturia and sharp lumbar or testicular pain in an otherwise healthy-looking person, calculus is greatly more probable.

It must be remembered that a calculus may be present in a strumous kidney; but this complication is an additional reason for removing the calculus. In certain cases of early strumous disease, it might fairly be expected that the removal or escape of the calculus would lead to the cessation and repair of the strumous changes; whereas, on the other hand, if the calculus be not removed, the destruction of the kidney will progress all the more rapidly.

Pathological effects of calculus. — The various morbid changes in and around the kidney, which are the results of renal calculi, have been described in the chapters on hydro-nephrosis, pyo-nephrosis, suppurative nephritis, perinephric abscess, renal fistula, and renal abscess. Little, therefore, requires to be said about them in this place.

Calculous pyelitis and pyo-nephrosis are caused by the obstruction to the outflow of urine, and to the presence of retained and decomposing urine.

Previous to the formation of pus, mucus sometimes is formed, and when the obstruction of the ureter is not complete, the passage of the mucus may cause as severe colic as the passage of a stone. When the obstruction is complete the kidney may atrophy, and the retained urine and pus may dry up into a putty-like concretion (Plate III., Figs. 2 and 3); or the kidney, having been converted into a large abscess cavity, may burst externally, or into the peritoneum, stomach, intestine, lung, or pleura. When the obstruction is incomplete or intermittent, lardaceous disease of the viscera may occur, or the patient may

be worn out after months or years by continuous suppuration, and die of hectic or exhaustion.

Besides the several consequences above enumerated, another must not be omitted, namely, *suppression of urine*. This may arise from calculus in the pelvis of each kidney, or in the pelvis of one and in some point of the ureter of the other. The kidneys may thus be simultaneously or successively disabled, more frequently successively, one kidney having been rendered useless before the other is at all incapacitated. Cases of fatal suppression from renal calculi in fat elderly people are recorded by Halford, Brodie, Travers, Paget, Roberts, Dickinson, myself, and others. The late Mr. Nunneley described a somewhat exceptional case, in that it occurred in a woman aged thirty-three.

Dr. Dickinson points out the not infrequent association between renal calculous disorders and epilepsy and insanity.

Treatment.—The treatment of renal calculus may be considered under three heads: (1) Prophylactic; (2) palliative; and (3) surgical.

(1) **Prophylaxis** consists in employing a moderate amount of well-selected food, so as to preserve the digestive and assimilative functions in good order. Animal diet is not harmful if taken in moderation, nor is abstinence from animal diet any security against calculus, as is proved by the prevalence of this disorder amongst the very poor, who scarcely taste meat. Immoderate eating and an excess of nitrogenised food unquestionably conduce to the formation of renal calculus, and each individual ought to ascertain for himself what is moderation in his particular case, according to his mode of living, amount of exercise, and peculiarities of system.

(2) If a tendency to gravel or calculus is evinced, the free use of alkaline drinks or distilled water is

recommended as a **palliative** measure; so also is the employment of acetate of potash, carbonate of lithia, citrate of potash, or carbonate of lime; and of saline aperients, such as sulphate of soda and magnesia; and the tartrates of potash and soda are also recommended. These remedies have, however, only a temporary effect, and for the most part the symptoms and the formation of calculous matter soon return after the discontinuance of the remedies. The waters of Vichy and Ems are prescribed by those who prefer the alkaline diluents; of Carlsbad, Pullna, and Friederichshall by those who advise the saline aperients. In either case, these waters are most advantageous when taken at their natural springs; the change of air, of mode of living, and of scene, all doubtless contribute to the improvement experienced.

During an attack of renal colic the palliative treatment consists in the use of anodynes in large and repeated doses, sufficient to keep the pain in check. By allaying spasm, these drugs also facilitate the escape of the stone; and, for the same purpose, the hot bath, hot opium, or belladonna fomentations to the loin and abdomen, and chloroform and ether inhalations, are useful. Anodynes may be given as morphia injections subcutaneously; or in the form of morphia, opium, or belladonna suppositories. Warm diluents and diuretic drinks are sometimes recommended, with a view of urging or pressing on the calculus by increasing the secretion of urine and its accumulating weight behind the stone. The patient should be kept in a relaxed posture, with the shoulders and thighs raised, thereby to diminish as much as possible the pressure of the abdominal parietes and contents upon the kidney.

The medicinal treatment of stone in the kidney is nothing more than the treatment of symptoms.

(3) The **surgical treatment** of renal calculus

must be considered under the heads nephro-lithotomy, nephrotomy, and nephrectomy.

It is very necessary, in order to gain a clear idea of the principles on which surgical treatment should be based, as well as a just view of the results of the two operations, that a sharp distinction should be drawn between nephro-lithotomy and nephrotomy.

Nephro-lithotomy aims at removing the stone, and leaving behind a useful and healthy kidney.

Nephrotomy consists in cutting into a disorganised kidney, whether the cause of the disorganisation is stone, tubercle, or simple abscess after injury. Inasmuch as stone is one of the commonest causes of pyelitis, and calculous pyelitis one of the commonest causes of renal tumours formed by purulent and urinous collections in its cavity, nephrotomy has been more frequently than not followed by the discovery of a calculus. But in these cases it has been the tumour in the flank which has led to the operation, the stone having been allowed to go on in its work of destruction until it culminated in a large abscess swelling, which it would have been unsafe, if not fatal, to leave unopened.

Nephro-lithotomy may be compared to the removal of a loose cartilage from a knee joint, whereby the integrity of the joint is restored by the excision of the foreign body. Nephrotomy corresponds to the removal of a sequestrum from a disorganised joint, when the best result that can be obtained is recovery with a crippled limb and the loss of the functions of the joint; but very probably, to save life, amputation may be needful. Similarly, before nephrotomy, the functions of the kidney have been greatly or entirely destroyed by disease; and very likely nephrectomy will be requisite to give the patient a chance of living.

Nephro-lithotomy, therefore, is the operation for stone in the kidney. Nephrotomy is the operation

for calculous pyelitis, or calculous hydro-nephrosis, or pyo-nephrosis, as well as for dilatation and suppuration of the kidney from tubercle and those other varied conditions which offer a mechanical obstruction to the outflow of urine from the kidney. Nephro-lithotomy is destined to save the kidney; nephrotomy is only performed when the kidney is in great part or entirely destroyed, and there is little or no kidney to save. To nephro-lithotomy the physician should look as a *means of preventing* the disastrous pathological changes which are sure to be produced by a calculus which is aggressive in its course. To nephrotomy he can only appeal as to the refuge of the destitute, to save his patient's life when he can no longer have any notion of saving his kidney.

Nephro-lithotomy, when considered from the point of view of the kidney, should be placed under the head of prophylaxis. Nephrotomy (like colotomy) is too often only an imperfect means of relief, not of cure.

There is, thus, a very wide practical difference between the two operations, and also between the conditions for which they are employed; and it is quite out of the range of valid argument to draw any conclusions from an indiscriminate collection of cases of two such opposite operations, as has been done in a recent medical work on renal and urinary affections.

The history of nephrotomy by M. Hévin, and the historical review of the treatment of pyelitis by M. Rayer, show that nephrotomy for calculous pyelitis and pyo-nephrosis was well established generations back. Nephro-lithotomy, on the other hand, had remained a mere name until it was performed on Dr. Coupland's patient in October, 1880. For 185 years, Marchetti's operation, as described by the patient and related by Charles Bernard, had been before the world. It had been quoted and commented on by author

after author; it had found its way into many standard works on the kidney and on general surgery; it has never been lost sight of by the profession. Hévin, Rayer, Velpeau, Freind, T. Smith, and many others, had copied Bernard's account, or had criticised the nature of the operation. But none had accepted the operation as a veritable nephro-lithotomy; nor had Bernard's report of it checked, or influenced in the least, the unwavering condemnation of every proposal to attack the kidney, *when not dilated into a tumour* or *perforated by a fistula,* for the purpose of excising therefrom a calculus.

The operation has been performed at least twenty times,* and in only two has it been followed by a fatal result: once from an overdose of morphia, and once from suppression of urine and disease in the other kidney.

Nephro-lithotomy should be performed when symptoms of stone are severe, and are not removed or rendered bearable by several months of medicinal treatment and rest; or when, in order to diminish or remove pain or hæmaturia, or both, the patient is compelled to abandon the ordinary pursuits of life, and pass his days as well as nights upon his couch. When anuria supervenes upon symptoms of calculus in one or both kidneys, the kidney which has last become affected should be first explored.

The symptoms which are sufficiently characteristic of stone in the kidney to justify an exploration of the kidney in search for the stone are: a history of hæmaturia; the presence of a little pus, or of crystals in the urine, together with fixed, or more or less constant pain in one loin, groin, or testicle, the pain being either of a dull aching or sharp pricking kind, paroxysmal, and occasionally associated with the other

* "This number excludes the cases where the kidney was the seat of abscess, or formed a tumour in the side."

symptoms of renal colic. It is no detraction from the value or safety of the operation, to have to record twenty-four exploratory operations where no stone was found. This is a reproach to our powers of diagnosis; but as all the patients easily recovered, it shows how small is the risk of the lumbar operation.

It will sometimes be possible to remove renal calculi from the body without performing either nephrotomy or nephro-lithotomy. This has many times been done where a fistula or a retro-peritoneal abscess has formed. In such cases it is only necessary to enlarge the fistulous opening, or to cut into the perinephric abscess from the loin. The calculus is then removed from the tissues outside the kidney, and into which it had escaped by the processes of suppuration and ulceration of the kidney.

The contemplation of such cases has led a medical author to remark: "The cautious surgery of nature is surrounded by safeguards which rarely attend the rougher operations of art." Here, it will be noted, by "nature" is meant a prolonged, often painful, and always destructive pathological process.

This may be the aphorism of the physicians, but I think surgeons will substitute for it the following: "The cautious and well-timed assistance of the surgeon is surrounded by safeguards which rarely attend the reckless operations of disease." The wise surgeon will not wait too long, watching the *vis medicatrix naturæ;* a force which, with renal calculous disorders as with so many others, too often ends by handing over the patient to the sombre solicitude of the undertaker.

Nephrotomy and **nephrectomy** for the various pathological effects of renal calculi have been considered under hydro-nephrosis, pyo-nephrosis, and perinephric abscess.

Nephrectomy for calculus uncomplicated by

pyo-nephrosis, hydro-nephrosis, or abscess, has been performed by Czerny, Kosiuski, and myself. But it should never be undertaken until after the kidney has been thoroughly explored, not only with the finger and puncturing needle, but also by incision of the calyces of the kidney, and a digital examination of the interior of the renal cavity. But, if a stone cannot be detected by these means, and yet symptoms point definitely to the presence of one, and the patient's life is useless or insufferable from the pain or hæmorrhage, it would be right and wise to perform nephrectomy. For the clinical account of my own case, and for the arguments in favour of the operation, I must refer the reader to my paper in volume lxviii. of the Med.-Chir. Transactions, and to the report of the discussion thereon in the medical journals of November, 1884. (*See* Plate IV., Fig. 2.)

CHAPTER XXX.

TUBERCULOUS AND SCROFULOUS KIDNEY.

Two forms of tubercle (so-called) of the kidney are met with. (1) *Disseminated tuberculosis*, and (2) *strumous pyelitis*, or *scrofulous pyelo-nephritis*.

These diseases are more common in children, and below the age of puberty, than in adult life; but they may occur, and more especially the scrofulous form of the affection, at any age. Men are said to be more frequently affected than women. Both kidneys are rarely involved in an equal degree, and the "scrofulous" form often affects one kidney only.

There are, however, some differences on these points between miliary tuberculosis and scrofulous kidney, which an examination of post-mortem records

brings out. In ten years at the Middlesex Hospital 44 cases of tubercular disease of the kidneys were met with in 2,610 examinations. Of these 44 cases 29 were of the miliary form, and 15 of the scrofulous, caseating form.

Of the 29 cases of miliary tuberculosis 18 were males, 11 females.

12	occurred in	persons under 10 years of age.
8	„	between 10 and 30 years.
6	„	over 30 years of age.
3	„	whose age is not stated.

In *two* of the 29 cases there was a spot or two (but not several) in one kidney, where small caseating nodules had been formed by the merging together of numbers of the miliary tubercles. In none of the 29 cases were the kidneys the only organs affected; in the greater number there was acute tuberculosis of the viscera, and serous membranes generally; in some the lungs, or lungs and larynx, were the only parts besides the kidney which were involved; the brain and its meninges were frequently complicated.

Of the 29 cases both kidneys were diseased in 28; the right kidney alone in one.

Of the 15 cases of scrofulous kidney nine were males, six females.

7	occurred in	persons over 30 (3 of them were over 50).
3	„	in adults whose ages are not stated.
5	„	in persons between 11 and 30 years of age.

There was not one instance in a child younger than eleven years.

In 4 of the 15 cases there was chronic phthisis.

In 5 general tuberculosis of the genito-urinary organs; in only one of these were the kidneys the only organs affected, and in that case there was a large perinephric abscess; in the other 4 cases the lungs were affected with chronic phthisis.

In 2 caries of the spinal column, with more or less general tuberculosis of the other organs.
In 1 suppurating elbow joint.
In 1 acute bronchitis and hypertrophy of the heart.
In 2 acute tuberculosis, chiefly involving lungs and liver, had supervened upon the longer-standing disease of the kidneys.

Of the 15 cases both kidneys were diseased in eight, the left kidney only in four, and the right only in three.

It must be borne in mind that the conditions found at death do not prove that the scrofulous kidney did not exist for some time as the only disease in the body, and that it may even have been the means of disseminating disease to other organs and parts.

It would appear from these figures, taken as they are from the records of a large general hospital, that miliary tuberculosis is twice as common as scrofulous caseating kidney; that miliary tuberculosis affects children under ten years of age in a large proportion of cases, whereas the scrofulous caseous kidney is at least somewhat exceptional in children below ten years of age; that miliary tuberculosis with unfrequent exception affects both kidneys, though not to an equal degree in all cases, whereas scrofulous kidney affects both kidneys only a little more often than it does one kidney alone. That scrofulous kidney is an affection of young and middle adult life, but occurs also in persons past middle age.

(1) **Tuberculous disease.**—In this form, minute miliary nodules are scattered through the kidney which is affected as part of a general constitutional malady. Other, and it may be several other, organs are involved as well. These miliary nodules begin as grey granulations around the terminal branches of the arterioles which lie between the pyramids of Ferrein.

These granulations infiltrate the vascular and

connective tissues, and flatten the uriniferous tubes between which they occur. They are seen on the surface as small white dots, and they extend along the pyramids of the medulla, having a great tendency to spread downwards along the submucous connective tissue to the ureter and bladder, and to involve also the vesiculæ seminales, prostate, and testes.

(2) **Scrofulous disease.**—Called also strumous pyelitis, scrofulous pyelo-nephritis, and the inflammatory form of tubercular disease of the kidney. Masses of cheesy infiltration commence in the substance of the renal papillæ, and extend deeply into the kidney as well as downwards to the submucous tissue in the renal pelvis. The body of the kidney is enlarged, and becomes lobulated by the extension of cheesy infiltration into the cortical parts of the organ; and on section, conical masses of this cheesy material in different stages of softening are found to correspond to the prominences of the lobules. The pelvis of the kidney and its ureter are contracted by the thickening of their mucous and submucous membranes; and at a later period the mucous membrane ulcerates, and the lumen of the tube is choked by the softened, caseous, or putty-like substance which escapes into it. Thus, often, both the mucous membrane lining the pelvis and infundibulum and the secreting and tubular substance of the kidney are affected; and the organ is converted into a huge abscess cavity, or into a series of large irregular abscess cavities with softened caseous or puriform *débris* for contents. These contents readily wash away, and leave exposed white, shaggy, ulcerated walls, in which there is scarcely any, if any, renal structure traceable. In some cases, where only one organ is involved, the kidney becomes a mere shrunken putty-like mass, in which abundance of cholesterine or calcareous nodules are formed in the lobulated spaces.

This affection often has a chronic course, and certainly has a much less tendency to spread along the ureter or to affect simultaneously other organs than has the disseminated tubercular disease. Strumous pyelitis attacks chiefly, that is, essentially, the calyces and pyramids, whereas tuberculosis begins in the cortex, and tends to spread rapidly to the rest of the urinary and genito-urinary organs. Scrofulous disease of the kidney sometimes spreads beyond the capsule of the organ, and involves the liver or the spleen, as shown in Plates V. and VI. taken from the same patient.

Symptoms.—*Disseminated tuberculosis* of the kidney produces no characteristic symptoms referable to that organ. In the early stages of *strumous pyelitis* the constitutional symptoms are not marked, and the local symptoms are absent. As the disease advances there is pain in the loin, with tenderness or pressure in the lumbar region. The urine may not be altered in quantity or character; or it may be excessive in quantity, in the early stage; and albuminous, alkaline, or acid, sometimes bloody, or containing pus, minute cheesy masses, and *débris* of renal tissue in the later stages. When it contains albumen the urine is always thick, cloudy, or opaque, and not clear, as in Bright's disease; moreover, it never contains casts of the renal tubes. Occasionally there is suppression of urine, more or less complete, and then uræmic symptoms usher in the fatal termination. Often a tumour can be felt, or there is a greatly increased area of renal dulness; and if the disease be on the left side, the spleen may be so much pushed forward as at first sight to give the impression that the tumour is an enlargement of that organ. I have seen this mistake committed more than once; and in one instance in which there were no marked urinary changes, and the patient suffered from ague, a small

ague-cake existed, and completely masked the large scrofulous kidney, from which the woman ultimately died.

Vesical irritation is a usual symptom, and in some cases has been the most prominent, and a very distressing symptom. A man was under my care who passed water with much pain and spasm on an average 160 times in twenty-four hours. At the post-mortem examination there was found scrofulous disease of the kidneys and ureter, the bladder having only quite recently become affected. In another case, micturition was incessant until the kidney was opened and drained. Dr. Dickinson goes so far as to say that the absence of vesical symptoms in presence of pus from the kidney would indicate pretty certainly that the pus is not tubercular. The converse of this, however, is certainly not true.

In the advanced stages there are marked rigors and exhausting sweats, or hectic. The temperature may be such as is seen in ague or hectic, or there may be intermittent periods of high fever lasting for two, three, or four consecutive days. Unless a tumour exists, or the characteristic cheesy *débris* is found in the urine, it is difficult, if not impossible, by the symptoms alone to distinguish scrofulous disease of the kidney from pyelitis or pyelo-nephritis, from any other cause.

Diagnosis.—In the early stages of the disease it is difficult, if not impossible, to diagnose scrofulous kidney from renal calculus. The chief reliance must be placed on the constitutional signs of tuberculosis: a poor and weakly physique with existing, or threatening, or past lung symptoms in a person between ten or fifty years old, who is suffering from suppurative pyelitis with an irregular and occasionally high temperature, and with vesical irritation, are pretty sure

indications of scrofulous kidney. The bladder symptoms are often the most prominent, and no relief from pain in the hypogastrium and the neck of the bladder is experienced except when the bladder is empty. In stone there is more likely to be hæmaturia, and the pyuria is generally intermittent; whereas in scrofulous kidney, blood is found in small quantity, and purulent urine is continuous, or if it ceases, the cessation is the result of occlusion of the ureter. Sometimes there is considerable induration and thickening about the ureter; and if the patient is thin, and has lax abdominal parietes, this condition may give rise to the impression that a calculus is impacted in the ureter. I have known this error made in a case in which nephrotomy was performed, and in which even at the post-mortem examination, and with the peritoneum alone intervening between the indurated ureter and the finger, the impression was maintained, until dissection showed the real state of things to be tubercular kidney and ureter, and no calculus at all. Uræmia and suppression of urine are by no means frequent symptoms, so that the absence of them is not a contra-indication of tuberculous affection. Nor is a palpable renal tumour sufficiently common in tubercular disease for its absence to influence the diagnosis. On the other hand, the kidney is sometimes so enlarged as to cause a tumour, which in all respects resembles a perinephritic cyst due to calculus or any other obstruction. In the early stages, before the urine becomes purulent, it may be albuminous, and when the disease is advanced the tubercle bacillus is said by Rabés to have been discovered in it. When the bladder becomes affected, as it so frequently does in the latter part of the disease, the urine is ammoniacal and ropy; but this condition of urine pertains also when the bladder is quite uninvolved, if the retained urine decomposes in the pelvis of the kidney. In renal

calculous disease the inflammation of the pelvis of the kidney does not run on into inflammation of the ureter and bladder; whereas in scrofulous disease it does. The discharges from the kidney in the latter disease inoculate the mucous membrane of the parts over which they pass, much in the same way as a scrofulous gland inoculates others in the course of the lymphatic circulation.

In the male, tubercular disease of the kidney is frequently associated with the same disease in the rest of the genito-urinary tract, so that an examination of the testes, the prostate, and vesiculæ seminales should be made, and if found to be nodular or irregularly indurated from new-formed deposit, additional weight will be thereby given to the diagnosis of scrofulous kidney.

Prognosis.—The prognosis is most unfavourable, especially when both kidneys, or one kidney and the bladder, urethra, or ureter, are involved in the disease.

The duration of the disease varies much, from a few months to four or more years.

Treatment.—The treatment consists in alleviating pain and improving the general health. Anodyne applications to the loin and lumbar region, and anodynes guardedly administered internally, together with cod-liver oil, bark, cream, or "maltine," and good bland nutritious diet must be employed. If the kidney has been converted into an abscess cavity of large size, or into a congeries of smaller abscess cavities, or if suppuration has been set up in the perinephric cellular tissue, nephrotomy should be performed, and the cavity well irrigated and drained.

Nephrectomy in *tuberculous* disease, in which the affection of the kidney is but a local manifestation of a constitutional disorder, would be useless, even if the other kidney were sound. When, however, the *scrofulous* disease is limited to one kidney, nephrectomy

PLATE V.

Fig. 1.—Portion of liver involved by contiguity with (Fig. 2) scrofulous kidney (R.), only half of which was affected.

Plate V.

Fig 1.

Fig 2

promises much as a means of prolonging life, by freeing the individual from a fatal malady.*

In cases in which the disease is not far advanced, it may be checked altogether by giving a free and direct means of escape for the pus of a small abscess. The relief which has sometimes followed an incision of the kidney in search for a stone, in cases in which no stone has been found, is to be explained in this way. In advanced cases of scrofulous kidney it may be a question whether lumbar nephrectomy had not best be performed without a previous trial of nephrotomy and drainage. This question must be settled by the conditions of the particular case. If the strength of the patient is so shattered that it is doubtful whether he could stand the shock of the operation; or if the disease is found on exposure of the kidney to be limited to one or two abscess spaces which could be freely and easily drained through the external wound, nephrotomy should be the operation in the first place. Subsequently, when the strength of the patient had improved, or, on the other hand, if from prolonged discharge there came to be a prospect of lardaceous disease supervening, resort should be had to nephrectomy. If the strength of the patient would bear the greater operation, and if from the enlarged size and bossed or nodulated surface of the kidney there was reason to think that the caseous nodules were numerous and considerable in area, it would be best to perform nephrectomy at once. To cut into one of several abscess spaces and to drain it, leaving others unopened and unable to discharge their contents, is unsatisfactory in theory, and unsuccessful in practice. It is true that after pressure is taken off by the evacuation

* Prof. Gross has collected twenty cases of nephrectomy for strumous diseases of kidney of which twelve recovered and eight died, showing a mortality of 40 per cent. "Nephrectomy: Its Indications and Contra-indications," July, 1885.

of one abscess, others which do not communicate with the wound do sometimes partly empty themselves through the pelvis and ureter; but this is uncertain and insufficient relief, and it would be far better in such a case to remove the kidney at once.

The surgeon must, however, bear in mind that it is in scrofulous diseases especially that the probability of the second kidney being likewise diseased is so great, and, therefore, he must be on his guard against the catastrophe of removing a kidney, and losing his patient within forty-eight or seventy-two hours or longer from uræmia, only to find on the post-mortem table that the opposite kidney had been destroyed as well. Dr. Dickinson tells us that "both kidneys are affected together in about as many instances as one separately. If only one be affected it is more often the right than the left, though in childhood this difference is not apparent. Of ninety-five cases, both kidneys were affected in forty-seven, one only in forty-eight."

Taking childhood, apart from other periods of life, of twenty-eight children under twelve years of age, nineteen had both kidneys affected, five the right only, and four the left only. Of sixty-seven persons over twelve years of age, twenty-eight were affected in both kidneys, twenty-two in the right only, and seventeen in the left only. It would thus appear that the chances of such a catastrophe are very much greater in operating upon children with scrofulous kidney than upon adults.

My own tables show that scrofulous disease (as distinct from tuberculosis) affects both kidneys at once a little more frequently than it does one alone.

It is in scrofulous kidney especially that we so much need the means of ascertaining the working capacity of the second kidney, and it is in these cases also that the difficulty of so doing is almost insuperable.

CHAPTER XXXI.

TUMOURS OF THE KIDNEY.

THE kidney is liable to many morbid growths of a cystic and solid character, both benign and malignant. Several of these do not attain to any great size, or cause the kidney to become appreciably, if at all, enlarged. Thus, *adenoma*, which occurs in two forms in the kidney (the papillary and the alveolar) is usually the size of a hazel-nut or walnut, but seldom, if ever, as large as an egg or small orange; *angeiomata cavernosa*, though distinct formations, or new growths of reticulated cavernous tissue, are of quite small size, not exceeding that of a marble, and though called tumours, the parts which they affect are often shrunken, rather than projecting, or enlarged; *leukæmic tumours* are small, scattered, roundish patches of lymphoid cells following the course of the capillary vessels, and looking not unlike extravasated white blood cells, though they are sometimes actively growing tumours of a truly malignant character; *lymphadenoma* is found in the kidney, associated with similar disease of the glands, liver, and intestine; *fibroma* occurs "in the form of small white knots of fibrous tissue near the bases of the pyramids,"* but occasionally in the kidney there has been found a very large simple fibrous tumour; *villous papilloma* occurs in the pelvis of the kidney, as it does in the urinary bladder, and in a case met with in the post-mortem room of the Middlesex Hospital,

* Moxon.

there were villous growths in the kidney* and bladder of the same person; *syphilitic gummata* occur occasionally, but do not attain such a bulk as to greatly increase the dimensions of the kidney; various sized and numerous *cysts*, as in granular kidney, are present, without adding to the size of the organ.

Though pathologically of the nature of "tumours," some of the above-mentioned new formations never, others only rarely, give rise to tumours, clinically speaking.

Clinically, any enlargement of the kidney which can be detected by physical examination at the bedside is spoken of as a tumour of the kidney. Some of these enlargements have been already considered; namely, hydro-nephrosis, pyo-nephrosis, renal abscess, and the enlargement of the kidney caused by scrofulous disease. There remain, however, other renal tumours, cystic and solid, for description; amongst the solid are carcinoma, sarcoma, and rhabdo-myoma, all of the nature of malignant new growths; and amongst the cystic are various forms of degenerated kidney and hydatid tumours of the kidney.

Renal tumours are amongst the most difficult of abdominal enlargements to diagnose correctly. They therefore demand close study. It will save repetition if I make some general remarks on the clinical characters of these tumours as a class.

The chief distinctive points about tumours of the kidney are the following:

1. The large intestine is in front of the tumour. Normally the right kidney, unless enlarged, lies a little way from the lateral wall of the abdomen, behind and to the inner side of the ascending colon; not in close contact with the abdominal wall and outside the ascending colon as the liver does. When

* There is also a specimen in the Middlesex Hospital Museum. (*See* Catalogue, No. 1822.)

enlarged the ascending colon is usually placed in front of and towards the inner side of the tumour. On the left side the descending colon is in front, and inclines towards its outer side below; in some cases coils of small intestine may overlie either right or left tumour, if the enlargement is not sufficient to bring the kidney into direct contact with the front abdominal wall. When the colon is empty, or non-resonant, it can be felt as a roll on the front surface of the tumour.

Bowel is never thus placed in front of a splenic tumour, and but rarely in front of one of hepatic origin. Rarely, if ascites is present and the liver is enlarged in an irregular and misshapen manner, the small intestines may float between the liver and the abdominal parietes.

2. There is no line of resonance between the kidney dulness and the vertebral spines; and no space between the kidney and the spinal groove into which the fingers can be dipped with but little resistance, as there is between the spleen and the spine.

3. Renal tumours do not project or protrude backwards to any marked extent. They fill up the hollow of the loin and may even cause some actual fulness there; but often there is nothing more than the effacement of the natural hollow of the loin. When the tumour attains a large size the parietes may be projected laterally to a degree sufficient to be observed by a superficial glance. Sir William Jenner says: "Renal tumours never cause enlargement behind. A renal tumour is not visible in the back, it expands in front. A little greater fulness of the loin there may be, but nothing like tumour . . . . Tumours due to disease of the kidney enlarge in front; whilst abscesses and other lesions which may simulate renal tumours often cause considerable posterior projection."

This is an important feature in relation to diagnosis, and if stated a little too absolutely it will serve

the more to impress a pretty general fact. There are exceptions, however, as I shall show farther on.

4. "The kidney is rounded laterally, rounded in front, rounded at its inner border, rounded at its upper border, rounded at its lower border. The inner border is usually lost against the spine, and the upper border cannot be felt unless the kidney is displaced. The kidney has no sharp edges. It is rounded on every side, and in disease never loses this peculiarity" (Jenner). Whether solid or cystic, and of whatever size, a kidney tumour is prone to retain some, often much, of its natural outline. The absence of any sharp edges marks off renal from many hepatic and splenic enlargements.

5. Renal less frequently and less markedly than hepatic, splenic, and suprarenal capsular swellings descend in inspiration. Hepatic and splenic, and more especially splenic enlargements, are depressed by the contraction of the diaphragm; whereas kidney swellings are often quite fixed in their position. If the kidney and circumrenal tissues have been inflamed the kidney will be bound down in its natural situation and there fixed. Sir W. Jenner remarks: "When the kidney is enlarged by disease it is rarely movable by respiration or palpation. When chronic changes, sufficient to enlarge the organ, have occurred, whatever their nature, adhesions sufficient to prevent movement usually form between the capsule and adjacent parts." Without doubt this is often so; but in cases of new growths, where the organ and parts around have not been the seats of inflammation there may be a considerable degree of movement. I have seen a renal tumour descend as much as an inch by a deep inspiration and fall forwards or backwards by its own weight with the movements of the body. I therefore agree with Dr. Dickinson in saying: "No certain inference is to be drawn from the fact that a

tumour descends with inspiration," and I would add, "or can be moved forwards and backwards by palpation."

Bright quite recognised this variation between fixity and mobility of renal enlargements in conformity with the variety of swelling; and he says, speaking of one of his cases, "On pushing the anterior part of the tumour backwards, the motion of the tumour was felt by the hand placed at the loin."

6. When the pelvis of the kidney is dilated the resulting tumour may press upon the liver so as to be indistinguishable from it; it may, and often does, reach down into the iliac fossa; and occasionally it extends inwards beyond the middle line of the abdomen. I have opened a hydro-nephrotic swelling which crossed the linea alba fully two inches. As a rule, however, renal enlargements never invade the pelvis, rarely reach the median line, and frequently are separated from the hepatic dulness by a resonant area.

7. When the tumour is large enough to reach the front wall of the abdomen, the most anterior point at which it comes in contact with it is commonly about the level of the umbilicus, or a little higher; the lateral wall between the costal margin and the crest of the ilium is then also bulged outwards. In a case recently under my care, the tumour presented a well-defined prominence the size of an apple immediately below the left costal margin; this prominence looked like a tumour situated in and projecting from the parietes, with its centre point in the linea semilunaris, and its inner edge reaching the median line along a distance of one and a half inches; it was, however, only a part of a large tumour weighing four pounds, and completely filling the left ilio-costal space. By palpation it could readily be moved; and it fell bodily against the anterior abdominal parietes when the

patient turned from the recumbent position on to his right side; it also moved freely with respiration. Plate II., Fig. 2, shows the outline of the tumour after its removal by abdominal nephrectomy.

8. A symptom in this particular case is one which might be expected to occur in large tumours of the left kidney, and not in splenic enlargements. There was a large varicocele of the left side, which had been gradually increasing with the growth of the tumour; and at the operation it was seen to be directly due to distortion and distension of the spermatic vein, which, with the inferior mesentery vein, curved over the front and inner side of the tumour, and was enlarged to the size of the ring finger.

There are a few exceptional features connected with renal tumours which must be remembered.

a. A right renal tumour may push the ascending colon down, instead of bearing the gut forwards in front of itself. A tumour of either kidney may push the bowel to its inner side towards or even beyond the median line, in which case there is no resonance in front of the tumour.* In the case just mentioned there was sometimes a line of resonance over a curved area of the tumour outside the dull and prominent portion; and when resonance was wanting a roll of bowel could be grasped with the finger tips. The tumour had grown forwards on the inner side of the descending colon, so that in the operation the bowel had to be drawn inwards quite across the front of the mass, after dividing the outer layer of the meso-colon.

In a case under Mr. Lawson in the Middlesex Hospital some years ago, a sarcomatous tumour springing from the cellular tissue at the hilum of the left kidney bulged forwards below the umbilicus on the left of the median line and was entirely in front of the bowel. The kidney, probably as the result of

* *Lancet*, Aug. 29th, 1885.

the drag of the tumour, had elongated the peritoneum into a mesentery, and had then floated forwards in front of the descending colon, sigmoid flexure, and small intestine. The tumour in some respects, therefore, resembled an ovarian.* In connection with this case I may allude to one, the notes of which I extracted from the Guy's Post-mortem Records, and which I have previously mentioned amongst the causes of acquired misplacement of the kidney; the left kidney of a woman, aged 57, who died of phthisis, was displaced on to the brim of the pelvis by a large cyst in its lower part which contained a pint of fluid. The cyst had dragged down the kidney and occupied the greater part of the pelvic cavity.

A case of an exactly opposite character to that of Mr. Lawson's was recently under treatment in the Middlesex Hospital.

A young woman had a tumour on the right side of the abdomen, first noticed after a fall, in which she struck the abdomen over the situation of the swelling. From the time of the fall she had had pain, very scanty urine and a high temperature and shivering fits. There was resonance in front. Pyo-nephrosis of the right kidney seemed probable, but was ultimately negatived by the occasional resonance of the right loin. An exploratory incision in the median line of the abdomen revealed, after pushing aside the intestines, first one and afterwards a second ovarian cyst of medium size; the right was suppurating, and pushed backwards by the left cyst, which in turn was confined to the pelvis, and hæmorrhage had taken place into it. The cysts were removed and the patient made a good recovery. Even after removal the right cyst was not unlike a distended and sacculated kidney, for the right Fallopian tube, greatly thickened and distended with pus, was

* *Lancet*, vol. i., 1866.

adherent over the lower half of one side of it, and communicated with it by a large opening, thus giving the tube the appearance of a dilated ureter.

b. Either a cystic or solid renal tumour may attain such a size as to occupy the greater part of the abdomen. Roberts quotes such a case of encephaloid left kidney in a boy aged six; Spencer Wells, an encephaloid in a girl aged four years; and Dickinson, a fluctuating sarcoma in a girl aged three years, which was mistaken for ascites; and a second in a girl of the same age which roughly resembled in appearance the swelling of pregnancy. I have recorded a case of cystic tumour of the left kidney in a man, which nearly filled the abdomen. In the Middlesex Hospital Museum there is a cancerous tumour weighing 31 pounds from the left kidney of a boy aged eight years.*

c. There are but few, if any, exceptions to the rule laid down by Sir W. Jenner, that renal tumours retain the rounded outline, and never present a sharp edge; but this does not at all imply that the normal outline of the kidney is retained in all cases. On the contrary, when the tumour involves only a part of the organ and not the whole, and therefore does not expand the entire capsule as it grows, it is unusual for it to have the renal outline. Plate II., Fig. 2, shows this.

d. Mobility of the tumour in respiration and by palpation is so far from being rare that it ought hardly to be enumerated amongst the exceptional symptoms.

e. A renal tumour may, as quite an exceptional thing, cause pointing on the posterior aspect of the body. Mr. Holmes has reported a case† of pulsating cancer of the left kidney in a man æt. 49. The disease

* *See* No. 1827, Mid. Hosp. Catalogue; and Path. Soc. Trans., vol. iii., p. 268.

† Path. Soc. Trans., vol. xxiv., p. 149.

was almost confined to the left kidney, but presented a swelling over the sacrum, and caused œdema of the back as high as the neck. The tumour weighed thirty ounces, and had so far destroyed the natural structure of the kidney that not a trace remained.

When malignant growth or abscess affects only part of the kidney, the abdominal tumour may appear to be somewhat removed from the strict limits of the renal region. Thus, when the upper part of the kidney is alone involved there is much upward bulging, and the tumour may be felt in the part usually occupied by liver or spleen. In malignant disease of the right kidney I have seen the tumour occupy a great part of the right hypochondriac region, and simulate a hepatic tumour.

f. Little or no reliance can be placed on the absence of changes in the urine. Solid tumours do not always cause hæmaturia, nor do accumulations of pus in the kidney always cause a discharge of purulent urine. The tumour may not involve the cavity of the kidney; or the ureter may be temporarily or permanently plugged, so that the urine which is passed may be quite normal. On the other hand, however, hæmaturia and pyuria associated with the physical signs of renal tumour are valuable adjuncts in forming a diagnosis. The best way of estimating the size of a renal swelling has been described by Rayer, Bright, Jenner, Freund, and others. As the patient lies on his back place the fingers of one hand flat upon the iliocostal space just outside the erector spinæ muscles, and those of the other hand flat on the front of the abdomen just over the hand which is behind. Then, during expiration, and whilst the patient's attention is diverted, a very fair idea will be obtained of the size and weight of the organ by depressing the fingers in front as much as possible, and tilting forwards those of the hand behind. In thin persons and with

the aid of an anæsthetic, this mode of examination is very effective. By its adoption a renal swelling too small to give rise to dulness on percussion will often be detected. Excepting in children and in persons much emaciated, a kidney which is recognisable by the touch is either movable, misplaced, or diseased. Sir W. Jenner points out, that when the lower dorsal and lumbar parts of the spine are curved well forwards, the kidney, even though only of natural size, may be sufficiently prominent to be seen through the abdominal parietes. He remarks that this condition is not uncommon in women, and adds that he once gave such a case, for examination, to the candidates for the degree of the University of London, and was told that the tumour (a healthy kidney, though probably somewhat larger than normal) was an ovarian tumour and should be cut out. A spinal or a perinephric abscess, or an effusion of blood or urine behind the kidney, will raise the kidney in front of it into a prominence which can be easily felt if not actually seen.

Stools in the ascending or descending colon may be mistaken for the kidney; but perhaps a more frequent error is to mistake an actual tumour for fæcal accumulations.

Having mentioned the usual and exceptional symptoms of renal tumours as a class, it will be well next to briefly state how they differ from other tumours with which they are likely to be confused.

(A) **From enlargements of the liver.**—Renal tumours often dip down or fade off so as to allow the fingers to be depressed between the edge of the costal cartilages and the upper border of the tumour. Hepatic tumours pass downwards from beneath the ribs, and so rarely do they have any intestine in front of them, that the presence of bowel in front of a tumour may be regarded as a strong indication that

it has not its origin in the liver. When the tumour is of the right side a jaundiced tint of eye, or skin, or urine, and stools deficient in bilious colouring, are suggestive, to say the least, of its having a hepatic origin. A tumour developed in the concave part of the liver is very likely to cause error in diagnosis, especially hydatids in the left lobe of the organ.

(B) **From enlargements of the spleen.**—The enlarged spleen has not bowel in front of it; it generally presents a sharp or well-defined edge, beneath which the fingers can be depressed; this edge is in some cases notched. There is resonance between the posterior edge of an enlarged spleen and the spinal column, and the tumour is traceable upwards beneath the ribs. A splenic tumour is movable; a renal tumour may be so, but often it is fixed in the loin. Splenic tumour will not cause varicocele, a renal tumour may do so.

(C) **Tumours of the suprarenal capsule** are not usually of sufficient size to form an abdominal tumour, but when they do it is not easy, if it is possible, to distinguish them from renal tumours. Nor is it clinically of importance to do so, since new growths of the suprarenal capsule, when of any consequence from their dimensions, involve the kidney and sometimes completely efface it.

(D) **From ovarian tumours.**—With an ovarian tumour the intestines lie behind; both loins are resonant; the tumour grows from below upwards, is generally more central, and either drags up the uterus or can be felt as a swelling in the pelvis by vaginal or rectal examination. An ovarian tumour exceptionally has intestine in front of it: (1) if of small size the bowel may not be displaced backwards by it; (2) adhesions may have formed between a coil of intestine and the front surface of the tumour, so that the bowel retains an anterior position.

(E) **Enlargement of the lymphatic glands** in the near neighbourhood of the kidney give rise to a swelling very similar to a renal tumour. The diagnosis may be made sometimes by the independent enlargement of one or more lumbar glands not forming part of the tumour; by the abruptness of the outline of the swelling; and possibly even by a protrusion from the growth along the spermatic cord into the scrotum.

(F) **From flatulent or fæcal accumulations** in the cæcum, sigmoid flexure, or colon, renal tumours may be diagnosed by the absence of intestinal disturbance, abdominal pain and colic, and of the distension by flatus which characterise over-distension of the bowel.

The proximity of the colon to the kidney renders the diagnosis between nephritic colic and intestinal colic sometimes difficult. Sir William Jenner wrote: "Nephritic colic will cause loss of power in the colon, and so induce constipation, thus favouring the idea that the patient has intestinal colic. Again, collections of stools in the colon may be mistaken for an enlarged kidney; a large enema will solve all doubt on this point."

Before the surgeon commits himself to a definite opinion in any doubtful case of abdominal tumour, the bowels ought to have been well opened and the examination of the tumour made immediately afterwards. It will be well to remember that just as there is incontinence of urine in retention, and incessant outpouring of fluid through the mouth in gastrorrhœa, so there may be frequent discharge of small stools from a bowel overloaded with fæces. An opinion should be deferred in some cases until after a second or third examination has been made, and until time has been allowed for the removal of fæcal accumulations if there are any.

(G) **Fæcal abscess, perityphlitis, or inflammation of the cellular tissue about the sigmoid flexure** will be distinguished by the marked febrile disturbance, the associated intestinal symptoms, the tenderness over the front surface of the part affected, and the lower position of the swelling, which will be in the iliac rather than in the renal region of the belly.

CHAPTER XXXII.

SOLID TUMOURS OF THE KIDNEY.

Carcinoma, sarcoma, and **myo-sarcoma** or **rhabdo-myoma** occasionally occur as primary new growths in the kidney. Carcinoma and sarcoma are much more frequently secondary than primary. Injury and the irritation of a calculus have, in several recorded cases, been the cause of primary cancer. Secondary carcinoma has, in quite a considerable number of recorded cases, been preceded by carcinoma testis; in other cases it follows cancer of the liver, stomach, breast, or uterus.

Of thirty cases of malignant disease, including cancer, sarcoma, and lymphadenoma, of the kidney found in 2,610 post-mortem inspections, twenty-five were secondary and five primary.

Of the five primary growths two were scirrhous and three encephaloid. In one case (male, aged seventy-six) the right kidney was infiltrated with a firm, white growth, it was enormously enlarged, weighing forty-nine ounces, and contained several large irregular calculi. Probably the calculi had been the exciting cause of the disease. In this case, and in one other (male, aged

sixty-four), in which the right kidney was converted into a mass of encephaloid cancer as large as a melon, the disease was confined to the kidney; in the other three cases there was secondary disease in other organs. In one the liver and colon, in another the liver and retro-peritoneal glands, and in the third the pancreas and omentum, were the parts thus secondarily affected.

Of the twenty-five cases in which the kidney was affected secondarily, ten were in males, fifteen in females. The primary seats of disease were the female breast in five; the female genital organs and bladder in four; the rectum in two; the omentum, duodenum, and liver each in one; *lymphadenoma* of stomach one, and of prostate one; *sarcoma* of the arm, of the axilla, of the pleura, of the orbit, of a fibroma of the uterus, and of the spinal dura mater each in one; *epithelioma* of the tongue in one, of the cervical glands in one.

As a primary disease, it affects one organ alone; as a secondary disease, usually both kidneys are involved. It occurs as a primary disease in children, before the fourth or fifth year, and in adults in advanced life. As a result of stone or laceration, it has caused death at the age of twenty-five. Though rapidly causing death after it has once commenced, it may require a long time before it is excited into existence: thus, twenty years have elapsed between a fall which gave rise to a renal calculus with a blood clot for its nucleus, and death from primary cancer of the kidney in which the calculus was situated.

All forms of cancer have been met with in the kidney, but the medullary and scirrhous are the most common, and medullary cancer is much more common than scirrhous. That which attains the greatest size is the medullary when it attacks children. Colloid cancer of the kidney is met with, like

PLATE VI.

Scrofulous kidney (L.) with spleen involved by contiguity.

(Plates V. and VI. represent both the kidneys of the same patient.)

Plate VI.

E Burgess del. et ch. lith.

tuberculosis and carcinoma, as a part of a general infection of the system.

Cancer begins either in the fibrous stroma of the cortex or in the epithelium of the renal tubes. Frequently, however, the proper tissue of the kidney is invaded by a cancer which has had its primary seat in the lymphatic glands or other structure about the hilum; and the disease putting on the form of the kidney after penetrating the hilum, and expanding the capsule, is called a "renal" cancer. Moxon thinks this the commonest plan of attack in primary renal cancer, and as it may be long before the renal pelvis is penetrated, and as the proper renal tissue remains long intact, we have, he says, the reason of the frequent absence of diseased products in the urine. The whole organ, in time, becomes infiltrated, and when the disease begins within the capsule this process is very rapid, and cysts and bloody or purulent collections form in the organ as the disease advances.

There is nearly always a tumour recognisable during life, and if the tissues around the kidney become adherent to the organ, the cancer sometimes advances outwards until it is immediately beneath the skin in the loin.

Symptoms.—The presence of a tumour in the loin is almost a constant symptom in renal carcinoma. This tumour, though sometimes tender, is, as a rule, painless, until, by its increased dimensions, it exercises severe pressure upon surrounding structures. The pain radiates far and wide, and perhaps increases paroxysmally; œdema, constipation, and vomiting, and jaundice if the right kidney is the seat of disease, are frequently present. Cancer of the kidney, like cancer of the bladder, causes frequent micturition and hæmaturia. Sometimes, when the kidney alone is involved, the irritability of the bladder is so great that the nephritic mischief is overlooked, and

primary cancer of the bladder is supposed to exist. Hæmaturia is not seldom noticed before the detection of a tumour: in some cases it is slight, or altogether absent; in others it is severe. Sometimes clots of blood partially block the ureter for a time, and then, after all the colouring matter has been washed out of them, are passed, *per urethram*, as colourless fibrinous shreds or columns. As a rule, the urine offers no indication of the nature of the tumour; but, occasionally, not only blood or coagula, but small calcareous masses are voided.

Diagnosis.—The diagnosis has to be made, first, as to the seat of the tumour; secondly, as to its precise nature.

The exact locality of the tumour when first seen, its direction of increase, and the line of surrounding dulness or resonance on percussion, will help to fix the renal origin of the swelling, as distinct from an origin in the liver, spleen, or ovary. But errors in this respect are sometimes unavoidable, and I have found, on post-mortem examination, a large cancer in the kidney of a man who had been supposed to be the subject of malignant disease of the liver. Similar errors as to the spleen, when the left kidney has been the seat of cancer, are on record. The rapidity of growth of the tumour, its unequal resistance and nodular outline, and the progressively cachectic aspect of the patient, point to cancer; and when a swelling, which began on one side of the abdomen, and in the renal region, of a patient either below the age of five or over that of sixty years, attains rapidly a very large size, its malignant nature may be diagnosed with fair certainty.

Whether in children or adults, it is no uncommon thing for these tumours to reach a weight of eight or nine pounds; sometimes they reach 30 or 40 pounds.

From enlarged mesenteric glands, renal cancer is

distinguished by its one-sided position and less nodular outline; from cancer of the colon or small intestine by the absence of characteristic intestinal symptoms.

The aspirating needle will furnish negative evidence, and will show that the tumour is due to one of the forms of solid growth, as distinct from cystic. It can do no more. The progress of cancer of the kidney is very rapid. The usual duration of life after the commencement of the disease is from eight or nine months to one or two years, according to the situation in which the growth has originated.

Treatment.—This can only be palliative in the middle and later periods of the disease. In the very early stage, could the growth be recognised then, nephrectomy would seem to offer a prospect of postponing the fatal result, perhaps, even, of considerably prolonging life, and, in exceptional cases, of securing permanent immunity.

Rhabdo-myoma or myo-sarcoma.—Cases of renal tumour, of probably congenital origin, and composed of striped muscle and sarcoma tissue, have been recently recorded by German and English pathologists. These tumours have been removed after death from infants of from six to eighteen months old. In some instances there has been a tumour of each kidney; in some, all vestige of normal kidney structure has been destroyed; in others, the tumour has lain beneath the renal capsule upon the surface of the kidney.*

A short paper on "A Classification of the New Growths of the Urinary System (Bladder, Prostate, and Kidney)" was published in the *British Medical Journal* of January 12th, 1884, by Mr. Paul, of Liverpool.

To this paper † I would refer the reader for some

* *See* Trans. Path. Soc. Lond., vol. xxxiii., pp. 312 *et seq.*, for cases by Mr. Eve and Dr. Dawson Williams.

† *See* also Osler's and Windle's papers in the *Journ. of Anat. and Physiology*, vol. xiv., p. 229, and vol. xviii., p. 160.

excellent information on the pathology of new growths of the kidney.

Mr. Paul has since reported a case of congenital sarcoma of the kidney, which weighed six pounds, in a female child.* Mr. Windle's paper contains valuable information on primary sarcoma of the kidney.†

Other cases are reported in the *Lancet* of Aug. 15th and Aug. 29th, 1885.

CHAPTER XXXIII.

CYSTS OF THE KIDNEY.

THERE are several forms of cystic disease of the kidney. (1) The small and numerous cysts which occur in granular kidneys, and which are of pathological rather than clinical importance. They never give rise to tumour, and are not amenable to surgical treatment.

(2) Conglomerate cysts or cystic metamorphosis of the kidney. This form of disease is sometimes congenital; sometimes found in adults. The kidneys thus affected are occasionally of great size, and present themselves as abdominal swellings.

(3) Dermoid cysts. Such cases occur in animals. There is a specimen in the Hunterian Museum containing wool rolled up with oil and fatty matter. It was removed from the body of a sheep, and was occupying the natural position of one of the kidneys which was deficient. I do not know of any instance of such a cyst in the human body. Though included in the classification of the Liverpool committee,‡ no specimen came under the direct or indirect notice of the gentlemen who formed that committee.

* *Medical Press and Circular*, April 30th, 1884.
† *Journ. Anat. and Phys.*, vol. xviii., p. 160.
‡ *See* Mr. Paul's paper, *Brit. Med. Journ.*, Jan. 12th, 1884.

(4) Simple cysts. (5) Hydatid cysts.

(6) Paranephric cysts, or cysts which are external to the capsule, and formed in the circumrenal fatty tissue, but which are intimately adherent to the kidney, and sometimes communicate with the renal cavity. They

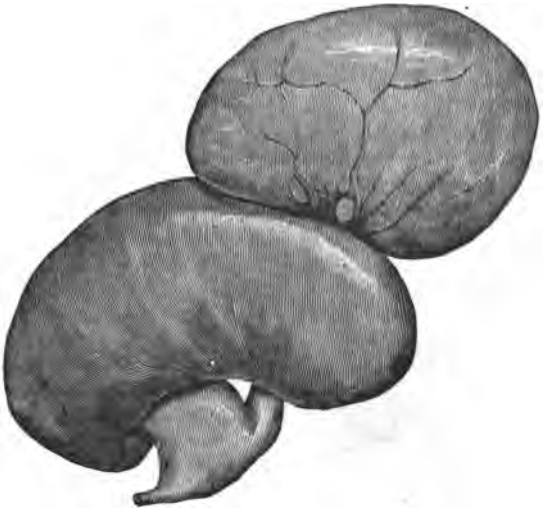

Fig. 36.—Large Simple Cyst communicating with a Calyx. Renal Pelvis dilated. (Middlesex Hospital Museum.)

are indistinguishable in their clinical aspects from some of the cystic formations of the kidney itself.

Simple or Serous Cysts.

Distinct from that form of cystic distension of the whole organ which results from obstruction in the ureter, and which is commonly known as hydronephrosis; distinct also from that rare form of disease in which the whole kidney is converted into a mass of

conglomerate cysts; and distinct, too, from the cysts of small or microscopic size met with in great numbers in the "granular kidney," there are simple cysts frequently seen in the kidneys of elderly people, one or more of which may attain considerable size, and so constitute a disease of great importance (Figs. 36, 37, 38).

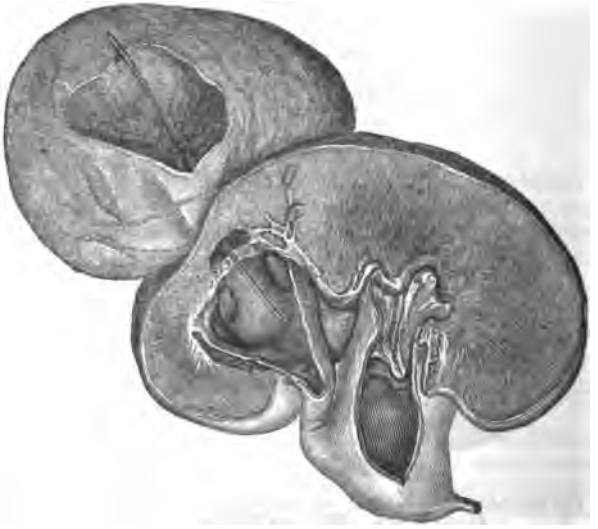

Fig. 37.—Another view of same Kidney as shown in Fig. 36.

In the museum of the Middlesex Hospital are some beautiful specimens of this form of cyst, though none of them are, perhaps, of a size to have formed a very noticeable tumour during life. In the Hunterian Museum there are three specimens of this sort, and the Transactions of the Pathological Society of London contain some cases scattered through its volumes.

Simple cysts cause no symptoms except those due

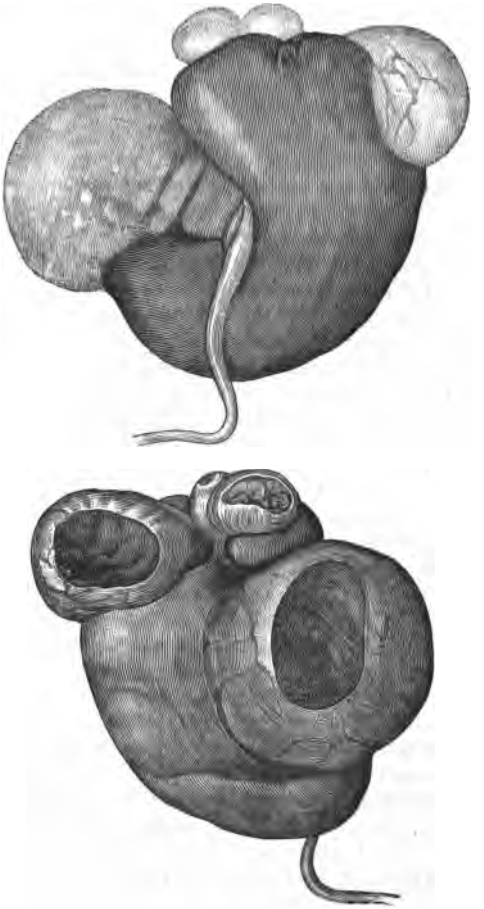

Fig. 38.—Two views of the same Kidney containing Blind Serous Cysts. (Middlesex Hospital Museum.)

to their size; probably not one-fourth of them reach a size large enough to attract attention during life; and not one-third could be detected if deliberately sought for by palpation.

The sizes of the cysts in the Hunterian Museum are respectively six, four, and three inches in diameter; two of them occur in granular kidneys; one has associated with it a few other cysts of the same kind, but only a line or two in diameter. The largest cyst is situated on the outer aspect of, but deeply embedded in, the kidney, the others are on the anterior surface, close beneath the capsule, and more or less coalesced with it. Of eight cases of cystic kidneys met with in 2,610 post-mortem examinations at the Middlesex Hospital, five were single cysts, and three were specimens of large cystic degeneration in the adult.

In one of the five cases of single cyst, the cyst was as large as a Tangerine orange, with thin walls, and growing from the lower end of the kidney; in another the cyst was filled with serous fluid, grew from the upper end of the organ, and was the size of a medlar; in the third the cyst grew from the upper end of the right kidney, the left kidney was granular, and had small cysts in it; in the fourth the cyst grew from the lower part of the left kidney, had calcified walls and gelatinous contents, and it was the size of a horse-chestnut; in the fifth case each of the kidneys had a single cyst, the size of an olive, filled with clear brown fluid. The ages of these patients were forty-nine, fifty-five, fifty-nine, nineteen, and sixty-one. All died of causes independent of the kidneys.

These simple cysts arise in the cortex of the organ, and project in relief from its surface, the rest of the kidney being healthy and functionally active, or it may be granular, or more or less atrophoid from the pressure of the cyst itself. Sometimes a communication is established between the cysts and one of the calyces

of the kidney (Fig. 36). The contents of the cysts are fluid, the fluid containing a small quantity of albumen and a little saline matter, but rarely, if ever, any urinary ingredients. Rokitansky was never able to discover in them even a trace of urinous precipitates or concretions. Dr. William Walter * records a case of cystic tumour in a floating kidney, for which nephrectomy was performed. The cyst contained ten ounces of a pale straw-coloured fluid, of specific gravity 1,013, holding two-fifths albumen; it was not urine. The walls of the cyst were very thin and tense, and of transparent bluish hue. In Mr. Cæsar Hawkins' case of "aqueous encysted tumour" of the kidney, the transparent fluid of the cysts contained no albumen, which suggests its possible hydatid nature; but Dr. Prout wrote of it, "The fluid is *serous;* I have not detected anything urinary in it." †

If hæmorrhage has taken place into the cyst cavity, owing to the giving way of some blood-vessel in its walls, the fluid will have a sanguineous colour and character. Moxon states that very often some of these cysts contain a thick jelly-like matter, like thin glue, and others a nearly solid substance which resembles the colloid matter found in other parts of the body.

The origin of these cysts is uncertain; possibly they arise from the conversion of the cellular layer in the Malpighian corpuscles into serous cysts, or from the dilatation of tubes or Malpighian capsules, or perhaps from vacuolation of epithelium.

But however this may be, we know that cysts of different origin, and even of varying microscopical structure, may secrete fluid contents which are physically and chemically alike.

Symptoms.—Simple renal cysts commence insidiously, grow slowly, present themselves first in the

* *Brit. Med. Journal*, September 29th, 1883.
† Med.-Chir. Trans., vol. xviii., page 186.

loin, or in the lumbar area of the front of the belly, and may be so hard at first as to be mistaken for solid growths. As they increase, they gradually monopolise the greater part of the abdominal cavity; their point of attachment ceases to be even approximately ascertainable, and when they occur in the female they may give rise to the idea of ovarian tumour.

Hæmorrhage may take place into them, and cancer has been developed in their parietes. As they grow, they tend to spread out the renal substance, so that a good part of the kidney may be stretched in a thin layer over the attached part of the cyst wall.

Rokitansky once found such a cyst of considerable size, and seated at the circumference of a kidney, inflamed and ruptured, its contents having escaped into the surrounding adipose tissue.

Diagnosis.—The difficulty in the diagnosis of these cysts will be apparent from the reports of such cases as those recorded by the author * and Dr. Bristowe.† The symptoms excited are merely those of pressure, and are therefore like the symptoms of other cystic swellings. The locality of the tumour in its earlier stages will somewhat aid the surgeon in correctly judging of the organ affected; but not even then in estimating precisely the character of the swelling. In Bristowe's case, in its symptoms, position, and cure by repeated tappings, the tumour resembled some of those false cysts which are formed by adhesions after rupture of the kidney or liver, ‡ and which have been described in previous sections. My own case in its early days was most like one of solid intermural tumour, and afterwards, like Bristowe's, might have been, if in a woman,

* Trans. Path. Soc. Lond., vol. xxii., p. 171.

† *Lancet*, May 5, 1883; and previously published in St. Thomas's Hosp. Reports.

‡ *See* article by author in Ashhurst's "International Encyclopædia of Surgery."

mistaken for ovarian disease. The relative position of bowel to ovarian cyst, as compared with that of bowel to renal tumour, would not have assisted a differential diagnosis in either instance. Nor did the character of the urine. Bristowe, in the same number of the *Lancet*, records another case which shows the difficulty of diagnosis and somewhat resembles his first case. The second, however, on post-mortem examination turned out to be one of round-celled sarcoma, growing from among the pelvic viscera, and containing a large hæmorrhagic cyst. The cyst was tapped five times, fluid of a reddish-brown colour, alkaline reaction, and specific gravity 1,024, being drawn off in quantities varying from seventy-four to one hundred and sixty-seven ounces.

Thus the difficulties which surround the diagnosis of these very rare cysts are extremely great; for not only may they be mistaken for hydatids of the kidney, hydro-nephrosis, and other renal tumours and perinephric fluid collections, but it is moreover almost impossible, after using every care in examination, to distinguish them sometimes from solid tumours in the parietes; sometimes from hepatic or splenic cysts, or cysts of the omentum, mesentery, or pancreas; sometimes from malignant cystic tumours springing from the pelvis or elsewhere within the belly, and sometimes (indeed, generally, in their later stages) in the female, from ovarian cysts.

Treatment.—The treatment of these cysts is the same as that of the hydatid cysts of the kidney, and of hydro-nephrosis and pyo-nephrosis. As soon as they have attained such a size as to cause inconvenience they should be tapped, and if they refill again and again, they should be cut down upon either in the loin or on the front or side of the abdomen, according to the indications in the particular case; and, after drawing off the fluid, the cyst should be cut into, and

the edges of the cyst stitched to the edges of the parietal wound.

Under these circumstances the cyst will collapse, and, either with or without suppurating, will probably close. If a fistula should remain and prove troublesome, the question of nephrectomy may be considered; but it must be borne in mind, that the kidney structure in these cases is functionally useful, and therefore the organ ought not to be sacrificed without specially strong reasons.

Cystic Metamorphosis of the Kidney of the Adult.

The large cystic kidney of the adult.—This is the result of a degenerative process. The whole kidney is converted into a vast number of conglomerated cysts of varying size, which leave unchanged scarcely any (if any) portions of the glandular structure, and give a greatly increased bulk to the metamorphosed organ. Sometimes the cystic masses are ten times as large as the normal kidney.

The shape of the kidney is fairly well retained by the enlarged mass, which often weighs a pound or two, sometimes five and six pounds; and in Dr. Hare's case (probably the largest on record) the left kidney measured fifteen and a quarter inches in length, and weighed sixteen pounds; and the right kidney was double its normal weight.

The medullary and cortical portions are alike replaced by the cysts which bulge the capsule and protrude on the surface as oval or circular translucent sacs. The cysts vary in size from microscopic minuteness to the dimensions of grapes or walnuts, the largest being often in the centre of the organ. In Dr. Hare's case one of the cysts held half-a-pint of fluid. They contain different coloured fluids, clear, pale straw-coloured, deep yellowish, purplish, or deeply

blood-stained. These various coloured contents are either serous, limpid and transparent, or viscid,

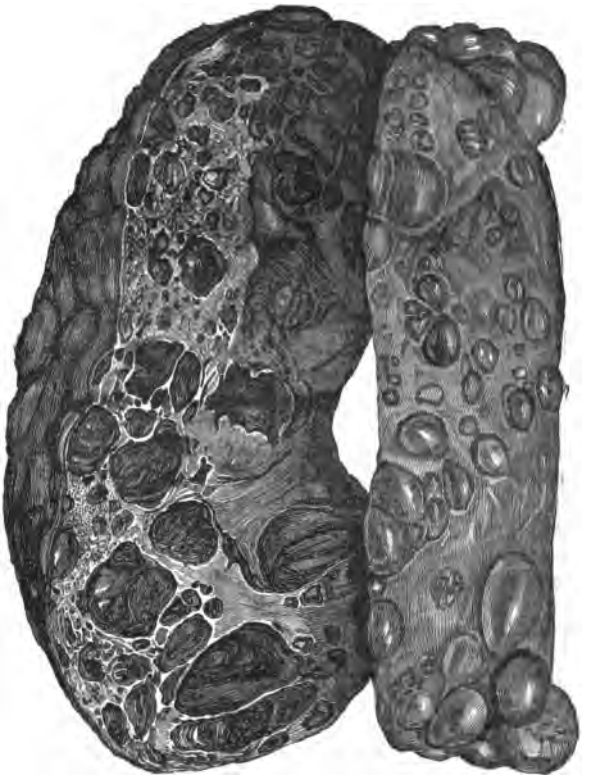

Fig. 39.—Cystic Degeneration of the Kidney. (Mid. Hospital Museum.)

treacly, colloid, or turbid, caseous, and almost solid. Occasionally they are purulent; sometimes even solid,

consisting of molecules of fat, epithelium, crystals of cholesterine, uric acid, and triple phosphates. The cysts do not communicate with the pelvis or calyces; nor with each other. They are closed cavities whose walls are excessively thin, and lined by a delicate layer of epithelium. They probably owe their origin to expansion of parts of the uriniferous tubules, and atrophy of the interstitial tissue. The original renal substance is in some places wholly removed, in other places small portions remain unchanged between the cysts. Sometimes the renal pelvis, but not the ureter, is much dilated. The dilatation is due to dragging, not to obstruction. In one of my cases the pelvis was enormously dilated. Both kidneys are commonly affected. Dr. Dickinson found only one case out of twenty-six in which the disease was confined to one kidney. Two out of the three cases in my list were, however, unilateral.

Drs. Bristowe* and Wilks and Pye-Smith have described cases in which the "large cystic kidney" has been associated in the same person with cysts of a similar nature in the liver and spleen. Dr. Pye-Smith's † case was one of cystic disease of the liver and of both kidneys in a man, aged fifty-three, who died of pulmonary gangrene, and to his description of the case he added a summary account of the other published cases, commencing with Dr. Bristowe's, which was the first.

Symptoms.—The clinical history of this disease, according to Wilks and Moxon, is much the same as that of Bright's disease, "of which, notwithstanding their vastly different appearance, these enormous looking tumours form only a variety. The cysts are, in short, an excessive production of that minuter cystic condition of the kidney which we have already described

* Path. Soc. Trans., vol. vii.
† Ibid., vol. xxxii., p. 114.

as occurring in granular kidneys."* As with granular kidneys, so with the large cystic kidney, hypertrophy of the heart is not unfrequently associated. In one of my three cases the left ventricle of the heart was much hypertrophied, the right kidney was converted into a congeries of cysts, the secreting structure almost gone, and the pelvis enormously dilated; the left kidney was large and granular, had a wasted cortex, and was puckered in places on the surface.

In a case, the specimen of which is in the Hunterian Museum, the patient at sixty-seven died of apoplexy; his vessels were atheromatous, and his heart weighed only nine and a half ounces. Both kidneys were enlarged and cystic; their state was not recognised during life. In another case, the patient, a sailor, aged fifty, developed symptoms of brain disease, became delirious, and died in a few days. Both kidneys were almost entirely converted into congeries of cysts. In a third case, a patient, a shoemaker, had for five years severe pain in the loins, and along the course of the ureters; his urine was scanty and always mixed with blood, or a purulent fluid. The other symptoms were numbness of the right leg, frequent severe headache, and occasional œdema of the lower limbs. Both kidneys were large and cystic, and the ureters were dilated.

The subjects of large cystic kidney (not congenital) are more often males than females; and are always adults, the majority being persons of middle age or older. The ages in my three cases were thirty-nine, fifty, and sixty-five. In two only out of ten specimens of this disease in the Hunterian Museum are the ages of the subjects given; these were sixty-seven and fifty. In twenty-one cases mentioned by Dickinson, the ages varied from twenty to ninety-eight

* Wilks and Moxon; "Pathological Anatomy," p. 515.

years, eleven of them being between forty and forty-nine.

In this disease there is no tendency to dropsical effusions; pain in the loins and hæmaturia, especially hæmaturia, are frequent and pronounced symptoms. In these three points reside the chief differences between large cystic kidneys and granular kidneys. Dr. Windle, of Birmingham, showed two large cystic kidneys, the cysts of which contained thin clear fluid. They were removed from a person whose clinical history was one of repeated hæmorrhages *from various surfaces*, but there was no special indication of renal disease.

When œdema occurs in a case of cystic kidney, it is the mechanical effect of the pressure of the tumour. The characters of the urine are like those of granular kidneys, pale in colour, abundant in quantity, of low specific gravity, and albuminous even when not admixed with blood. Coagula and granular casts are occasionally found in the urine, and more rarely pus in small amount.

Diagnosis.—When with a sallow complexion, hypertrophy of the heart, and increased arterial tension, the above characters of urine and a tumour in each of the renal regions, or a tumour in one and an increased fulness in the other are found, the diagnosis of "large cystic kidney" is pretty clearly indicated.

The tumour which is formed is soft, but does not fluctuate, and presents the usual topographical characters of renal tumours in general.

In the last stages of the disease obstinate vomiting, convulsions, suppression of urine, and coma supervene, and then follows death. Death sometimes occurs from exhaustion brought on by hæmaturia, sometimes from bronchitis or pneumonia, sometimes from œdema of the lungs, and sometimes from some quite independent cause. Of the three cases in my list, the

causes of death are stated as follows: In one bronchitis, congestion of the lungs, and morbus cordis; in one epithelioma of the tonsil and soft palate; and in the third epithelioma of the penis.

When death is caused immediately by the state of the kidneys, the manner of death is most frequently by uræmia.

The progress of the disease is not usually very rapid, from two to five years being a common time.

Treatment.—The surgeon's aid will not often avail, owing to the frequency of the bilateral character of the disease, and to the fact that when the disease is unilateral the elimination of urine is carried on sufficiently well by the sound kidney, and no treatment is requisite unless the size is very inconvenient.

GENERAL CYSTIC DEGENERATION OF THE KIDNEYS OF CONGENITAL ORIGIN.

"Congeries of renal cysts" are sometimes congenital, and lead to enormous abdominal distension of the fœtus in utero. Parturition is thus occasionally rendered difficult, or even impossible, and the child, when born, presents the appearance of one having an ovarian cystic tumour. Cystic degeneration with abdominal distension is a cause of death of the fœtus in utero, or during birth, and it is sometimes found associated with various malformations such as talipes, cleft palate, and imperforate anus.* I have the report of a case dissected by my friend and former pupil, Mr. John Palmer, of a child born at the eighth month, and which lived five hours after birth. Both its kidneys were wholly composed of cysts; and the anus, rectum, urethra, and external genital organs were absent. Besides, the bladder was misplaced or

* Transactions of London Obstetrical Society; also Proceedings of Medico-Chirurgical Society for 1876 (Lond.).

malformed, the sigmoid flexure was malformed, the uterus was arrested in its development, and the outlet of the pelvis was smaller than natural. Congenital cystic degeneration or metamorphosis of the kidney has no clinical importance for the surgeon. Drs. Lever and Duffey and Prof. Virchow have described cases of the sort. Koster has also written on the etiology of the disease. The case mentioned above supports Koster's views.

Paranephric Cysts.

Paranephric cysts are neither developed in the kidney nor due to a dilatation of the renal cavity or pelvis. They encroach upon the surface of the kidney from without, and if they have any communication with the interior of the kidney, it is supposed to be only secondary, and due to a fistulous passage formed between the cyst and the kidney.

One cyst of this kind was found in the 2,610 post-mortem records of the Middlesex Hospital, which were made during ten years. The case occurred in a woman, aged seventy-five years, who died of carcinoma of the small intestine. The ureter of this kidney was obstructed by the cancer and the renal pelvis was dilated and filled with urine. Behind this kidney there was a large cavity containing clear fluid; the anterior wall of this cavity was formed by the kidney capsule; the posterior and lateral walls consisted of condensed perinephric cellular tissue. A small passage extended from the cyst to the dilated renal pelvis.

Various cysts have been described as paranephric; thus Dr. Dickinson so speaks of a case recorded by Mr. Cæsar Hawkins, in the eighteenth volume of the Royal Medico-Chirurgical Transactions, but it seems to me more probable that the origin of the aqueous encysted tumour described by Mr. Hawkins

was more of the nature of the single simple serous cysts developed from the substance of the third kidney which existed in that case:

It occurred in a boy, aged six; the cyst filled the entire right side of the abdomen from the false ribs to Poupart's ligament. In the walls of the cyst was a small mass of renal substance consisting of a lobule with cortical and tubular portions complete, but no excretory duct. The mass was a small third kidney. The cyst was punctured during life, and five pints of aqueous fluid free of albumen and urinary salts were found in it after death.

A specimen is contained in the Museum of St. George's Hospital of a cyst which held four pints of clear albuminous fluid, and formed an abdominal tumour in a woman, aged thirty-seven, who died in consequence of being knocked down in the street. The cyst protruded from the back of the renal pelvis, with which it communicated, but the pelvis was not dilated nor the ureter obstructed.

Treatment.—Such cases require to be treated like hydatid and simple cysts and hydro-nephrosis; namely, they should be punctured once or oftener, and if a cure does not result therefrom, but the fluid again and again accumulates, they should be opened and drained, the edges of the cyst being stitched to the edges of the wound in the abdominal parietes.

HYDATIDS IN THE KIDNEY.

Hydatid cysts form large tumours in connection with the kidney. They are comparatively rare, occurring only once for every five or six times they are met with in the liver, and being somewhat less common than hydatids in the lungs; but they are more frequent than hyatids in any other tissue or organ of the body except the liver and lungs.

Pathology.—The left kidney seems to be nearly twice as frequently affected as the right, owing, perhaps, as suggested by Béraud, to the greater attraction of the liver for those which travel to the right side.

than of the spleen for those which go to the left side. The cyst may be immediately beneath the capsule or lodged deeply in the substance of the kidney; in either case, as it grows, it forms an elastic, rounded, and sometimes fluctuating tumour projecting from the surface of the organ. The whole kidney may ultimately be destroyed by the cyst, which may come to fill a large part of the abdominal cavity; in other cases it remains quite small, and does not exceed the size of an egg or an orange.

A renal hydatid cyst may burst into the pelvis of the kidney, or into the intestine or lung. Dr. W. Roberts, of Manchester, tells us that it has a natural tendency to discharge its contents by the ureter, and out of sixty-three cases collected by him, hydatids were discharged by the urethra in fifty-two cases. In forty-seven the cysts opened into the pelvis of the kidney only, in one into the pelvis of the kidney and the lung, in three into the intestine, and in one into the stomach, as well as into the renal pelvis. In one case the opening was into the lung only, in two the cyst was opened artificially, and in eight cases it did not open at all. Roberts states that there is no authenticated case of a hydatid cyst of the kidney opening in the loin; and that Rayer's two cases which so opened were hydatids in the muscular tissue of the lumbar region. In a third case there was post-mortem proof that the cyst was unconnected with the kidney.

Hydatid cysts of the kidney as of the liver may inflame and suppurate; or may wither, contract, and dry up into a putty-like mass consisting of phosphates, cholesterine, and fatty granules, together with echinococci, hooklets, or shreds of laminated membrane. An abscess near the kidney, or perinephritis, may be excited by the presence of the tumour. Hydro-nephrosis has resulted from impaction of a vesicle in the ureter.

Symptoms.—In some instances there are no symptoms, and the cyst is met with as a post-mortem surprise. In others there are no symptoms until the cyst bursts, in the common manner of the disease, into the renal pelvis, when attacks of renal colic begin and recur from the passage of the daughter cysts and portions of the hydatid membrane along the ureter. In a third class of cases there is an abdominal tumour, with or without the symptoms excited by the escape of the contents of the cyst along the urinary passages.

In eighteen out of sixty-three cases, according to Dr. Roberts, a tumour in the side was discernible during life, and varied in size from an orange to an adult head. Fluctuation is not always to be detected, owing either to the extreme tension of the cyst walls, or to the small proportion of fluid to daughter and granddaughter cysts. The hydatid thrill or fremitus has been only seldom observed. The hydatids discharged *per urethram* are in various states, broken or entire, as fragments, or vesicles simply collapsed; there may be one or two only, or scores of vesicles; some contain only water; others have minute cysts within; crystals of uric acid have been found adhering to them; crystals of triple phosphates, uric acid, and oxalate of lime have been found within. When the parent cyst has suppurated before bursting, pus is discharged as well as hydatids. Blood is sometimes discharged in the urine. In a case of which I have notes, the cysts were mixed with large quantities of pus in the urine, but some of the smaller and unruptured cysts contained the ordinary clear saline and non-albuminous fluid characteristic of hydatids. In some cases, hooklets, shreds of hydatid membrane, and oil particles, but no vesicles, are found in the urine.

In relation to the discharge of hydatids by the urethra, it must not be forgotten that hydatid cysts

of the liver have sometimes discharged into the renal pelvis, and hydatids in the cellular tissue of the pelvis or in the track of the ureter have broken into the bladder or ureter, and thus escaped by the urethra. Such cases are infinitely rare. Mr. Birkett* knew of one case in which hydatids were withdrawn by a catheter from the bladder, the cysts having escaped into the bladder from a hydatid tumour between it and the rectum. Other similar cases of hydatid tumours in this situation opening into the bladder are on record; but they are to be distinguished from hydatids in the kidney by the formation of a pelvic tumour, and by the prolonged and increasing pressure effects upon the bladder and rectum.

The escape of the vesicles may or may not excite nephritic colic; there may be one or several discharges at longer or shorter intervals of a few months or several years. Sometimes at the first escape the cyst empties itself and dries up; in other cases there have been numerous periods of escape over many years, and at uncertain and very variable intervals.

Pain in the lumbar region and along the course of the ureter of the affected organ, with a sensation of something giving way, usually precedes the discharge. Rigors, vomiting, spasmodic colicky pains, and sometimes suppression of urine and retraction of the testicle, accompany the passage of the vesicles along the ureter, which takes from a few hours to several days; then comes a period of relief during their stay in the bladder, and this is followed by the distress, retention and painful efforts to micturate, which indicate their journey through the urethra.

An accident such as a blow, kick, or fall, or the jolting of horseback or carriage exercise, may lead to the rupture of the tumour, and to the first or to any subsequent escape of the vesicles.

* *Med. Times and Gaz.*, vol. i., p. 161; 1855.

When a tumour exists it fills the loin, and to a greater or less degree the corresponding side of the abdomen; it may be quite round and regular in outline, or present a somewhat nodulated surface. Its relations to the bowel and to the ribs and surface are the same, and are subjected to the same exceptions as renal tumours generally. (*See* page 488 *et seq.*)

In a case shown by Dr. Fotheringham * to the Glasgow Pathological Society, the patient had a nodulated tumour which filled the right lumbar region and caused pain and tenderness; there were, too, the ordinary symptoms of Bright's disease. Within a fortnight after suppurating, and discharging pus and cysts by the urethra, the symptoms of Bright's disease disappeared.

Suppuration may occur as the result of violence, or of puncture, whether for the purpose of diagnosis or treatment; or independently of either. If it occurs, then rigors, fever, and increased pain and tension about the tumour set in.

Prognosis.—The prognosis of renal hydatids is not always unfavourable. Dr. W. Roberts' list of sixty-three cases yields twenty in which recovery was believed to have been permanent; nineteen which were fatal; in the remainder (twenty-four) the results were not known. In ten of the fatal cases the cause of death was directly due to the hydatids bursting into bronchi, to pleurisy, the effects of pressure of the tumour, or of suppuration of the contents. In one case a large renal calculus was found with the hydatids in a solitary kidney, and the hydatid tumour opened into the renal pelvis, and thus obstructed the outflow of urine. In nine cases the causes of death were unconnected with the hydatids.

The duration of the disease is uncertain, but often very prolonged. Patients have gone on passing

* *British Medical Journal*, Dec. 6, 1884.

vesicles at intervals for twenty and even thirty years. There are no means, except by waiting, of telling whether more remain behind after some have escaped by the passages. If, when the cases are left untreated, the prognosis of hydatid tumours of the kidney is more favourable than that of similar tumours in the liver or other internal organs, it is because of the tendency to rupture into the renal pelvis. When the tumour is small and situated in the central parts of the kidney, the evacuation is easy and safe. There is no fatal case on record when the vesicles have escaped per urethram from a renal hydatid cyst which had *not* given rise to an abdominal tumour. The discharge of pus with the vesicles is not necessarily unfavourable; cases have recovered where the quantities of pus discharged have been very great. When the cyst breaks into the pleura or bronchi the probability of recovery is not good; when into the bowel or stomach it is much more favourable. When the cyst grows continually, and does not burst in any direction, the dangers of a large tumour and of its pressure effects have to be met.

Diagnosis is made certain when, with a tumour in the renal region, there is a discharge of hydatid vesicles, or of the other products of hydatid tumour, by the urethra. If the cyst does not rupture into the renal pelvis, the urine presents no evidence of the nature of the disease; and if a tumour exists without discharging its contents by the ureter, there is nothing to point out the precise nature of the enlargement except the use of the aspiratory trocar. The renal origin of the swelling must be diagnosed by the same means as other renal tumours. When vesicles are voided, but no tumour exists, nephritic colic generally indicates the locality of the hydatids.

Treatment.—When a tumour increases without discharging *per urethram* the only proper treatment

is to cut down upon the tumour, and having tapped and emptied it of its fluid contents, to incise it, and stitch the edges of the cyst to the margins of the parietal wound. The cysts should be opened from the loin if possible; if not, then at its most prominent or projecting point. Aspiration may be tried before incision, but is less surely successful.

CHAPTER XXXIV.

METHODS OF PERFORMING THE OPERATIONS ON THE KIDNEY.

BESIDES the use of the trocar or aspirator, there are four recognised surgical operations resorted to for renal diseases and injuries.

1. *Nephrotomy* (νεφρός = kidney; τέμνω = I cut) is an incision into the kidney for purposes other than the extraction of a calculus, though it is quite possible that a calculus or calculous matter may be removed after the incision has been made. Thus, on laying open an abscess of the kidney, one or more calculi may be detected lodged within the pelvis or calyces of the organ; or having ulcerated its way through the kidney, the stone may be found lying outside in the circumrenal cellular tissue.

2. *Nephro-lithotomy* (νεφρός = kidney; λίθος = stone; τέμνω = I cut) is an incision into the secreting substance or pelvis of the kidney, with the express purpose of removing a calculus therefrom; and that, too, at a date in the progress of the disease prior to the disorganisation of the renal substance, or to the conversion of the renal pelvis into a large abscess cavity.

3. *Nephrorraphy* (νεφρός = kidney; ῥάπτω = I sew) consists in cutting down upon and exposing the kidney,

and then stitching it to the edges of the wound in the parietes. It is undertaken with the object of fixing a floating or movable kidney.

4. *Nephrectomy* (νεφρός=kidney; ἐκτέμνω = I cut out) is the complete removal of a kidney either through an opening in the loin or by laparotomy

Puncturing the Kidney

with a trocar or the aspirator is performed for the relief or cure of hydro- and pyo-nephrosis, large isolated serous or blood cysts of the substance of the kidney, and hydatid cysts. When from their degree of distension such swellings are causing serious consequences by pressure, or there is risk of the cyst wall rupturing, the contents ought to be evacuated.

The point selected for puncturing will depend on circumstances. If there be any spot over the swelling which is thin, soft, prominent, or fluctuating, the trocar should be there inserted. A point which is not seldom indicated is midway between the umbilicus and the anterior superior spine of the ilium; or half an inch below, and an inch and a half to the side of the navel. When no particular spot is suggested by discoloration or prominence, no better place can be selected on the left side than an inch in front of the last intercostal space; but if the tumour be of the right side this is too high, as the liver would probably be traversed. If there is no indication for operating elsewhere, the best spot to select when the kidney is of the right side is half way between the last rib and the crest of the ilium, between 2 and 2½ inches behind the anterior superior spine of the ilium.*

In performing the operation the aspirating trocar should be inserted without any previous incision of the skin; if a larger trocar be used, an incision

* *See* paper by the author in Trans. of the Roy. Med.-Chir. Soc., vol. lix., pp. 242, 243; 1876.

through the integument and muscles is sometimes made before introducing the instrument.

The dangers of the operation are very slight. If, however, the puncture be made too far forwards and through non-adherent peritoneum, some of the contents of the cyst might be extravasated into the peritoneal cavity on withdrawing the canula, an accident which has proved fatal in more than one case. There is also the danger of wounding the intestine, which, as a rule, is in front of and adherent to the tumour; and if the trocar be long, and be thrust too far inwards, it might penetrate some important blood-vessel, and cause dangerous if not fatal hæmorrhage. The penetration of the thin edge of the liver with an aspirating needle, though to be avoided, is not an accident likely to be followed by any ill consequence. The instrument should not be introduced too near the ribs, for fear of wounding the pleura.

NEPHROTOMY

is an operation of very ancient date. It is performed for hydro-nephrosis when the cyst refills rapidly after having been punctured, and in cases in which, owing to the persistence of the cause of obstruction, or the threatening rupture of the cyst, simple puncture is inappropriate; for hydatid cysts under similar circumstances, or when, from the number and size of the daughter cysts, the contents cannot be evacuated through a small tube; for pyo-nephrosis, and for any case in which the kidney had been converted into an abscess sac, whether from the presence of calculus or tubercle.

The incision is precisely the same as for lumbar colotomy, except that as the kidney is situated a little nearer the median line than the colon, the deep part of the wound should be kept a little posterior to that in colotomy. A slightly oblique incision should be made in

the ilio-costal interspace, beginning over the outer edge of the erector spinæ, and continued forwards for three inches and a half. After dividing the skin, superficial fat, and fascia, the outer border of the latissimus dorsi and the posterior border of the external oblique of the abdomen will be brought into view, and should be divided to the full extent of the superficial incision. It is unnecessary to open the sheath of the erector spinæ. Next, the internal oblique and the aponeurosis of the transversalis must be cut through, whereupon the outer border of the quadratus lumborum will be seen, and may be divided if the muscle is very broad or in the way; the deep layer of the lumbar aponeurosis must be divided. No grooved director or other guide is necessary to reach this stage; a scalpel and a pair of dissecting forceps for the operator, and two well-formed deep retractors for his assistant, being all the instruments required, beyond two or more pairs of torsion pressure forceps to control hæmorrhage from vessels cut in the division of the parietes. The circumrenal fatty tissue having thus been reached will, in all probability, be found condensed, and otherwise much altered, from the inflammatory process which has gone on in and around the kidney; and if the operation be done for abscess of the kidney, suppurative changes will perhaps have taken place in the structures forming the bed of the kidney. When this tissue has been divided the distended pelvis, cyst, or abscess (as the case may be) of the kidney should be either first tapped or at once cut into, its contents evacuated, and the cavity well irrigated with some disinfecting solution. If it be thought desirable (as in hydro-nephrosis and cysts of the kidney it is) to stitch the cut edges of the cyst to the edges of the skin, this should now be done. Four or five sutures will be ample for this purpose. A drainage tube should be inserted into the kidney, and

the greater part of the wound left to granulate, though the anterior extremity of the parietal incision may be brought together by one or more sutures with advantage.

The dangers of nephrotomy are not in the operation, but depend entirely upon the condition of kidney for which the opening is made. The operation itself is very simple. When done for cystic tumours, the probability is that with a free drain for its contents the cavity will soon contract, and the wound close by granulations; when done for hydro-nephrosis or pyo-nephrosis set up by some permanent obstruction in the ureter, a continuous and persistent flow of urine, or pus mixed with urine, must ensue, and unless this fistula is cured by nephrectomy, a receptacle into which the fluid can trickle and be retained should be adjusted to the loin and constantly worn. Such an instrument has been made for me by Mr. Hawksley, and also by Messrs. Maw.

When nephrotomy is performed for abscess, recovery may take place; but if the kidney is completely converted into an abscess sac, or is the seat of breaking down scrofulous deposit, the patient, though benefited for a time, may be worn out at length by suppuration or hectic.

NEPHRO-LITHOTOMY.

This operation was first performed by myself in 1880. It has since been repeated by several other surgeons; altogether the operation has been performed twenty-one times, and in nineteen instances with a good result. It should be done unhesitatingly in all cases in which symptoms of renal calculus continue uninfluenced by medicinal treatment, and are sufficiently severe to interfere materially with the comfort and usefulness of the patient's life. If for several months a person has

been subject to more or less constant pain in one loin, and along the ureter, and perhaps also in the testicle of the same side; if there have been recurring attacks of renal colic, and especially if with these symptoms there is occasional hæmaturia or the urine is constantly charged with a little pus or albumen, we have the conditions not only justifying but demanding an exploration. If, in addition to these symptoms, a small calculus or a little calculous matter has been passed per urethram, the presence of a stone is almost certain.

Operation.—An incision is made four and a half inches in length parallel with and three-quarters of an inch below the last rib. The structures divided are the same as in nephrotomy. In nephro-lithotomy, if the quadratus lumborum be so wide as to contract the deep part of the wound, its outer edge may be incised to the extent of half or three-quarters of an inch. All bleeding vessels having been twisted, and hæmorrhage quite stayed, the assistant should stretch the edges of the wound widely apart by suitable retractors, and the operator with two pairs of dissecting forceps tears through the perirenal fat. As he approaches the back of the kidney there will be sometimes noticed a difference in the character of this fat, that immediately in contact with the kidney being finer in texture and of a delicate primrose colour. If from the presence of the stone there has been inflammation in the tissues around the kidney, this appearance will not be expected, and the whole of the tissue will probably be dense and tough.

When the kidney has been fairly reached, the index finger should be passed carefully over the whole of the posterior surface of the organ, including its pelvis, and any inequality of surface, or increased hardness, or resistance at any particular spot, should be searched for. During this tactile exploration,

indeed throughout the whole of the examination of the kidney, the abdominal walls of the patient should be well supported by an assistant, or well arranged pillows, so that the kidney should not be pushed forwards by the exploring finger. If nothing suggestive of the presence of a stone is thus felt, the kidney should be freely exposed to view by drawing aside the edges of the wound, and a fine needle should be passed into the renal substance. This should be done in a systematic way, and in several places if the stone be not at once struck, introducing the needle here and there, so as to puncture in succession the several calyces of the kidney, in one or other of which experience tells us the stone usually rests. If in the course of the digital exploration some one spot gives more resistance than the rest, this should be first punctured, but otherwise the puncturing should be done in a well-planned manner. On this point I would lay great stress, as it is quite possible to puncture in a dozen places, and yet to miss the calculus.

If by this means the calculus is not detected, the search should not be given up until the fingers of the right hand are passed round the outer edge of the kidney, and the front surface felt over in the same way as the posterior. Whilst doing this, in order to give counter-resistance to the exploring finger, the kidney may be pressed against the psoas muscle, or be squeezed between the finger and thumb. Despite all these means a calculus may escape detection. I have removed, by lumbar nephrectomy, a healthy kidney for a calculus, the size of a marble, embedded in it, but which I could not localise (Plate IV., Fig. 2). Even after the removal of the kidney, the locality of the stone could not be made out by pressing the organ between the finger and thumb; nor by pressing upon the kidney as it lay upon a table. The man recovered

well, but the loss of so good a kidney is a source of regret; yet it was unavoidable. The kidney becomes very hard and tough under the prolonged irritation of a stone, so that whilst the whole organ feels firmer than natural, any slight difference in the degree of resistance of one part is all the more difficult to appreciate. This hardness of the renal substance should make the surgeon very suspicious of a calculus, and future experience will, I think, encourage him, when this condition is present, not to be satisfied either that no stone exists, or that nephrectomy must be performed, until he has made such an incision into the kidney as will open each of the calyces. Kidney wounds are known to heal readily, and whilst the risk of such an incision would not equal that of nephrectomy, the subsequent condition of the kidney would be preferable to the possession of only one organ.

Having detected the stone by one or other of the methods above described, the overlying part of the kidney should be cut into with a narrow straight bistoury; then with a scooping movement of the finger introduced through the incision, the stone, unless a branched or very large one, can be raised to the surface of the parietal wound on the point of the finger. Or a pair of forceps might be passed into the kidney by the side of the knife, and the stone seized and withdrawn. The finger is, however, much to be preferred, and if the incision is small, as it ought to be, the finger serves the purpose of plugging the renal wound, whilst it lacerates the renal tissue to the necessary extent. By this plan the hæmorrhage is minimised, and the rent made with the finger heals as readily as the cut. When equally convenient to reach the stone, it is best to open the secreting structure and not the pelvis of the kidney; the wound in the former heals better than in the

latter, and the chance of a urinary fistula is therefore much less.

If the calculus be large and branched, it may possibly be requisite to break it up into two or more fragments, and remove the fragments separately. I have known this done in a suppurating kidney, but it is not probable that a stone will attain such a size as to require breaking before removal, without having in its growth more or less destroyed the kidney structure. A stone an ounce in weight has been removed entire from a kidney not markedly enlarged nor the seat of advanced suppuration.*

The after-treatment is very simple: a drainage tube should be left in the back part of the wound, and the rest should be closed by sutures. For a time, of course, the whole or greater part of the urine secreted by the injured kidney will be discharged through the loin, but after gradually diminishing it will cease altogether in from a few days to a few weeks. These loin wounds usually heal very quickly. In nephrotomy, as in nephro-lithotomy, some simple dressing, such as lint soaked in terebene and oil, or spread with boracic ointment, should be applied over the wound, and the drainage tube should pass through this, and be covered with a thick pad of absorbent cotton-wool, boracic or salicylic charpic, or Lister's gauze, retained in place by a light bandage. The dressings will require frequent changing, as they soon become saturated with the urine. To keep the bedding dry, a large pad of finely powdered German moss peat should be placed beneath the loin to receive and absorb the urine; and this it readily does.

The dangers of nephro-lithotomy are not great. 1. Hæmorrhage from the wounded kidney is not likely to be serious if the plan suggested above be followed. 2.

* Bennett May; Clinical Transactions, vol. xvi. London, 1883.

Cellulitis may follow the operation, but with due precaution as to antiseptic cleanliness and drainage this will almost certainly be escaped. 3. Renal abscess might possibly follow the operation as the result of wounding an organ already long irritated by the presence of a calculus. 4. A renal fistula or a more superficial purulent fistula may follow; but the chances are against it, and even such a result would be a welcome substitute for the ceaseless pain and chronic invalidism of the condition which it replaces. 5. I have known lumbar hernia follow an exploratory incision down to the kidney. The rupture was in the situation described by Jean Petit, and reducible.

Nephrorraphy

was first performed by Dr. E. Hahn, of Berlin. It is practised in cases of floating, movable, or wandering kidney, in which the organ, besides being mobile, is the seat of frequent, severe, and spasmodic attacks of pain; or of more or less continuous suffering. It consists in fixing the kidney in the loin, and is performed by exposing the kidney through an incision in the loin, such as that described for nephrotomy or nephro-lithotomy. This done, strong catgut sutures should be passed through the renal capsule and the edge of the parietal wound. By tightening and knotting the sutures the kidney is fixed back against the lumbar parietes. The wound should be stuffed with carbolised gauze or boracic lint, and left to heal by granulations.

Nephrectomy,

or the removal of the kidney from the living body, was first performed as a planned operation in the human subject by Gustav Simon, of Heidelberg, in April, 1869.

Lumbar nephrectomy should be performed in

cases in which the removal of a disorganised kidney is advisable after nephrotomy has been tried, and failed to improve the condition of the patient; in cases of nephro-lithiasis for which nephro-lithotomy is not practicable; in cases of ureteral urinary fistulæ; in cases of wounded or ruptured kidney which are injured past the probability of functional repair; or in which blood clots are being forced into the ureter and plug it so as to lead to urinary extravasation into the loin, or to acute nephritis of the injured organ and threatening symptoms of secondary peritonitis. It should also be selected for cases of renal cystic tumours, and small or medium-sized solid tumours of the kidney, and for some cases of painful movable kidneys which are condemned to removal. Other cases of large tumours, and of wandering kidneys very loosely held by a mesonephron, are better dealt with by the abdominal method. But here I would emphatically endorse the teaching of Simon, who laid it down as a cardinal principle that extirpation of a kidney is only permissible when a patient's life is seriously threatened by disease, and all other remedies have failed, because renal disease is more dangerous in persons with only one kidney.

The suffering caused by a floating kidney ought, therefore, to be quite unrelievable by other means before the patient is exposed to the great risks, operative and prospective, of nephrectomy; and in renal calculus no pains should be spared to procure relief by nephro-lithotomy before proceeding to the much graver operation of excision.

The advantages of lumbar operation are twofold: (1) the peritoneum is not opened, and (2) the wound permits of excellent drainage. It is performed most easily by the transverse or slightly oblique incision, as in nephrotomy, and made somewhat nearer the last rib than in lumbar colotomy; with this should be

conjoined a second incision, running vertically downwards from the first, and starting from it about one inch in front of its posterior extremity. In making the first incision, which should be about four and a half inches in length, the operator must not go nearer than half an inch of the twelfth rib, for fear of wounding the pleura, which sometimes descends a little below it. The second incision may be left until the kidney has been reached and explored, and it can then be made by cutting from within outwards with a probe-ended bistoury, steadied by the index finger of the left hand. One great advantage of the vertical incision is the increased facility it affords for passing the ligatures around the pedicle. Other incisions have, however, been employed.

The kidney being reached, the next step is to separate it from its surroundings. When no circumrenal inflammation has existed, the colon, peritoneum, and fatty tissue will easily be detached from their connection with the kidney by the index finger of one hand worked close against the capsule of the organ. It will generally, I think, be found, that even when no inflammation has occurred some of the renal capsule will be torn off and left behind; in other cases, as when the operation is performed for calculous or scrofulous pyo-nephrosis, and as a subsequent proceeding to nephrotomy, the kidney should be enucleated from its thickened and firmly adherent capsule, and the latter left behind with the pedicle. (*See* Plate I.) The next step is to pass a double ligature of plaited silk through the pedicle, between the ureter and the vessels. This is done by means of an aneurism needle, fixed in a long handle, whilst the kidney is dragged well up into the wound by the left hand of the operator, one of the fingers of which can at the same time be acting as a guide for the needle. The needle passed and withdrawn, the ligature silk should be

divided, and one-half of it should be tied tightly around the vessels and the other half around the ureter. In doing this the ligatures should be pressed well inwards towards the side of the spine, so as to leave plenty of room between them and the hilum for dividing the pedicle. The kidney should now be drawn quite out of the wound, a proceeding which is sometimes very difficult, but which will be greatly facilitated by dragging the lower ribs forcibly upwards with the fingers of the left hand dipped into the wound. I would lay special emphasis on this point, as being of much assistance in this step of the operation. Another ligature should be thrown round the whole of the pedicle, and securely and tightly tied before cutting the kidney free, which is now safely done by snipping through the ureter and vessels with a pair of blunt-ended scissors.

Any bleeding points should at once be seized and ligatured or twisted; and it is very probable that when the wound comes to be fairly looked into, as it can after the kidney is cut away, some moderate-sized vessel will be found bleeding. Some aberrant branch of the renal, or one of the inferior suprarenal arteries, or the branch to the upper end of the ureter or to the connective tissue of the loin, all branches from the renal trunk; or one of the parietal branches of the aorta, may require control.

All the ligatures should be cut off short, and the pedicle dropped into the wound. A drainage tube should be fixed in the wound, the edges brought together with waxed silk or fishing-gut sutures, and the form of dressing commonly employed for fresh wounds by the particular operator should be applied. The patient should be kept in the recumbent position until healing is complete, and the drainage should be kept up for four or five days. Healing is, as a rule, rapid, though the drainage track will require from three to

four weeks to close perfectly, and it is well that during all this time complete quietude should be observed and great care given to the diet, so that the other kidney may not be irritated by too great concentration of urine secreted by it. Some surgeons attach importance to the separate ligature of the artery, vein, and ureter; others, again, think it is unnecessary to ligature the ureter; and others that the ureter had best be stitched to the external wound. The most important thing, however, is to securely control the vessels without putting too great a strain upon them in doing so. To attempt in all cases to get the kidney on to the surface before ligaturing the vessels would be to run a great risk of lacerating the coats of the artery or vein beyond the point at which it is possible to apply the ligature; the advantage of leaving the ureter untied has yet to be proved. In no case is it advisable to excise the last rib, and where the ilio-costal space is very narrow some other form of operation, not the lumbar, should be adopted.

The dangers of the lumbar operation are that (1) the peritoneum or the colon may be torn open; (2) too great strain on the vessels of the pedicle may cause their laceration, or the ligatures may slip after the kidney has been cut off; (3) the kidney may be broken in the manipulations for separating or withdrawing it. All these accidents have occurred, but they are not necessarily fatal. The laceration of the kidney requires the hæmorrhage to be controlled by pressure, and by hastening the completion of the operation; a great safeguard against hæmorrhage from laceration is the application of the double ligature before attempting to withdraw the kidney. If the ligatures have slipped, or fail to control the vessels of the pedicle, or if troublesome hæmorrhage from any source arises, it will be best managed by the application of one of Wells' large ovariotomy forceps, which should be left

in the wound, and will, in addition, act very well instead of a drainage tube. If the colon be torn, the rent should be closed by suture; if the peritoneum is opened, it may be either sutured or not, as without stitches the surfaces will fall together and quickly adhere. In one recorded case of scrofulous pyelitis, the hole in the peritoneum was sutured, but before this was done pus from the kidney had contaminated the inner surface of the peritoneum, yet the patient rapidly recovered, and the operation, which lasted two hours and a half, was throughout all but bloodless.

Abdominal nephrectomy should be performed in cases unsuited to the lumbar method. They have been already specified (page 531). The best incision is that which many of the old surgeons employed in all abdominal sections, and which Langenbuch, of Berlin, has recommended and practised in at least two successful cases of nephrectomy,* namely, along the outer border of the rectus abdominis on the side of the kidney to be removed. The mid-point of the incision will probably be the umbilicus, but this must entirely depend upon the size and outline of the tumour.

All bleeding, and it is sometimes considerable in this incision, being stopped, and the peritoneal cavity opened, the existence of the opposite kidney can be ascertained, if need be, by digital examination. The intestines should be kept aside from off the surface of the kidney to be removed by means of a large flat sponge introduced into the abdomen. The outer layer of the mesocolon should then be opened sufficiently to allow of the introduction of two or three fingers behind the peritoneum and into the fat in front of the kidney; the fingers should then gently tease their way towards the renal vessels, around which ligatures should be secured. If the vessels are tied separately, care

* Transactions of the International Congress, 1881; p. 278.

should be taken to secure the artery before the vein. The ureter should then be seized by two pairs of ovariotomy forceps and divided between them. Langenbuch's object in selecting this incision was to divide the outer layer of the mesocolon, and so avoid risk of hæmorrhage; this is more particularly necessary on the right side, since the inner layer of the mesocolon covers the vessel passing to the ascending colon. The enucleation of the tumour should next be proceeded with; lastly, the vessels should be divided outside the ligatures, and the mass removed from the body.

The ureter should now be tied with ligature silk, like the vessels, or, if thought necessary, stitched to the edge of the wound.

Abdominal nephrectomy is completed like ovariotomy, and the subsequent treatment is the same.

The dangers of the operation are peritonitis, hæmorrhage, pulmonary embolism, pyæmia, and exhaustion from suppuration; these are more frequent causes of death after abdominal nephrectomy than after lumbar, in the proportion of 18 to 5; whilst the number of deaths from uræmia, vomiting, and shock, after lumbar nephrectomy, as compared with abdominal, is 14 to 5. The greater mortality of lumbar operation from uræmia and shock is due to the fact that in several of the lumbar cases it was subsequently proved that both kidneys were diseased at the time of operation; that in one case the last rib had been removed and the pleural cavity laid open; in another the patient was reduced by cancer of the uterus; and others were in an unfit state for any surgical operation of importance. The abdominal operation, therefore, seems to be a much more formidable procedure; and the fatality from causes directly traceable to the operation, and apart from the state of health of the patient, is much higher after it.

Though in some cases from size of tumour the abdominal operation is easier, and therefore safer, the lumbar method is, as a rule, much safer, and to be

Fig. 40.—Elongated Calculus, almost filling Ureter. (St. George's Hospital Museum.)

The right ureter, and a portion of the bladder and left ureter. A calculus, 5½ inches long, occupies the right ureter.

preferred in all cases where the kidney is not greatly enlarged, where the tumour can be reduced by puncture, and when the loin space is not too much contracted.

Ureterotomy.

It has been suggested in some passages in the foregoing pages, that in certain cases of impaction of a foreign body in the ureter, an operation ought to be performed for its extraction. When the impaction is at the lowest part of the ureter, within the substance of the vesical wall, in fact, a calculus may be felt, and removed from the bladder after median urethrotomy in the male, or dilatation of the urethra in the female.* When impacted higher up in the course of the ureter (as in Fig. 40), it may be removed after opening the abdominal cavity.† At present, however, ureterotomy *has not a history*, as have the renal operations above described.‡

* *See* article by the author in *Amer. Journ. Med. Sciences*, Oct., 1884.

† *See* case by Dr. Cullingworth in Path. Soc. Trans., vol. xxxvi.

‡ For a careful analysis of the results of the various operations on the kidney, based on nearly four hundred and fifty cases of different operations, I would refer the reader to Professor S. W. Gross's article: "Nephrectomy; Its Indications and Contra-Indications," in the *American Journal of the Medical Sciences*, July, 1885.

INDEX.

Abdominal aneurism, Ruptured, 189
—— nephrectomy, 535
—— tumour from hydro-nephrosis, 301
Abnormal position of unsymmetrical kidney, 75
Abscess of the kidney, 272
——, Causes of, 273
——, Pathology of, 277
——, Symptoms of, 278
——, Treatment of, 280
Abscesses, Formation of, Symptoms of penetrating wound of kidney, 158
Absence of both kidneys, 112
——, Specifications of cases of, 112 *et seq.*
—— of kidneys and defective generative organs, 106
—— of one kidney, 63
Acquired causes of hydro-nephrosis, 293
Acquired misplacements of kidney, 20
—— Details of cases of, 20
—— mistaken for abdominal tumours, 22
Acute interstitial nephritis, 356, 367
Affections that may be mistaken for perinephritis, etc., 230
Ague different from suppurative nephritis, 381
—— distinct from urinary fever, 421
Air, Extravasation of, 186
Anterior surface of kidney, 1
Appliance for closing ureter, 111
Atrophy of one kidney, 65, 76
——, Causes of secondary, 79
——, Diagnosis between congenital absence and, 76
——, Variations of, in rudimentary kidney, 80
——, Variations of, in ureter, 81
——, whether congenital or induced by disease, 79
Belt and pad for movable kidney, 39
Bladder, Irritability of, through renal disease, 441
Blood, Extravasation of, 188
Bougie, Fever due to use of, 415
Boundaries of kidney on posterior surface, 5
Bright's disease, acute, Distinction of pyelo-nephritis from, 378

Calculus in kidney, Perinephritis from, 220
—— in ureter, 22
——, Renal, 451
Cancer in the kidney, 496
Carcinoma, 495
Cases in detail of hydro-nephrosis, 311 *et seq.*
—— of blood extravasation, 193
—— of prolapse of kidney through wound, 182
—— of pyo-nephrosis at Middlesex Hospital, 338
—— of single kidney, Examination of, 66
Catheterisation on Polk's system, 108
Catheterism, Hæmorrhage from kidney through, 435
Causes of floating kidney, 45
—— of interstitial nephritis, 356
—— of perinephric extravasations, 185
—— of perinephritis, consecutive on diseases of kidney, 207
——, whether primary or secondary, 239
—— of renal abscess, 273
—— of secondary atrophy, 79
—— of subparietal injuries, 116
—— of suppurative nephritis, 367
Chronic cystitis not suppurative nephritis, 380
—— inflammation in perinephric tissue, 223
Cicatricial kidney after suppurative nephritis, 395

Classification of fusion of kidneys, 90
—— of perinephric abscesses, 205
—— of urinary fistulæ, 254
Clots of blood from bladder, Removal of, in wounds of kidney, 174
Colic, Renal, in renal calculus, 457
Completely united variety of fused kidney, 97
Congenital atrophy of kidney, 55, 79
—— causes of hydro-nephrosis, 291
—— hydro-nephrosis, 325
——, Features of interest in, 330
—— ——, interference with parturition, 338
—— ——, association with malformations, 330
—— ——, elimination of urine in fœtus, 332
——, Fluid in cysts formed in, 328
—— misplacements of kidney, 17
——, Consequences of, in parturition, 18
——, Details of cases of, 18
Congestion of kidneys in urinary fever, 404
Congestive forms of urinary fever, Varieties of, 407
Constipation in subparietal injuries, 147
Contents of perinephric extravasations, 185
Cyst, Urine capsuled within, 201
Cystic degeneration of kidneys of congenital origin, 513
—— diseases of the kidney, 500
—— kidney of adult, Large, 508
—— ——, Diagnosis of, 512
—— ——, Symptoms of, 510
—— ——, Treatment of, 513
—— metamorphoses of kidney in adult, 508
Cysts of the kidney, 500
——, Hydatid, 515
—— ——, Diagnosis of, 520
—— ——, Pathology of, 515
—— ——, Prognosis of, 519
—— ——, Symptoms of, 517
—— ——, Treatment of, 520
——, Paranephric, 514
—— ——, Treatment of, 515
——, Simple or serous, 501
—— ——, Diagnosis of, 506
—— ——, Symptoms of, 505
—— ——, Treatment of, 507
——, Various forms of, 500

Definition of term "single" kidney, 63
Details of remarkable cases in subparietal injuries, 148 *et seq.*
Diagnosis between congenital absence and atrophy of one kidney, 76
—— of extravasation of blood, 192
—— of hæmorrhage from kidney by catheterism, 437
—— of hydatid cysts, 520
—— of hydro-nephrosis, 314
—— of interstitial nephritis, 330
—— of irritability of bladder through renal disease, 447
—— of large cystic kidney, 512
—— of malformation of kidney, 53
—— of movable kidney, 35
—— of penetrating wounds of kidney, 162
—— of perinephritis, etc., 230
—— of pyo-nephrosis, 348
—— of renal calculus, 462
—— of simple cysts, 506
—— of single kidney, 100
—— of solid tumours of kidney, 496
—— of subparietal injuries, 135
—— of suppurative nephritis, 378
—— of tuberculous kidney, 478
—— of urinary fever, 420
Diet in subparietal injuries, 142
—— in urinary fever, 430
Difference between renal and other tumours, 492
Difficulty in determining atrophy as congenital or due to disease, 79
—— in diagnosis of renal calculus, 465
Diffusion of urine escaped from pelvis of kidney, 200
Disease, Secondary renal affections through, 282
Distended gall bladder mistaken for movable kidney, 37
Distension of cavity of kidney with blood clot, 139
Distinction between floating and movable kidney, 46
Distinctive points about tumours of kidney, 484
Double ureter to kidney, 59
Dyspepsia in renal calculus, 460

Early closing of abscess undesirable, 244
—— incision of abscess and continued drainage successful, 246
Effusion of blood in perinephritis, 221
Electric lamp for bladder, 111
Etiology of hydro-nephrosis, 291

Etiology of movable kidney, 27
—— of perinephritis, 206
—— of pyo-nephrosis, 337
—— of urinary fever, 400
Examples, etc., of fusion of kidneys, 84 *et seq.*
Exceptional features connected with tumours of kidney, 488
Extension of perinephric abscess, 223
External wound, Prolapse of kidney through, 181
Extravasations, perinephric, Traumatic and non-traumatic, 185
Extreme degrees of fusion of kidneys, 83

Fæcal extravasation, 204
Features of interest in congenital hydro-nephrosis, 330
Fever, Urinary, 398
Fibrous tissue of kidney, 8
Fistulæ communicating with kidney and pelvis of kidney, 255
——, Urinary, 254
Floating kidney, 45
——, Cases of, excessively rare, 47
——, Causes of, and to what due, 45
——, how distinguishable from movable, 46
——, Treatment of, 48
Fœtus, Urinary discharge from, in congenital hydro-nephrosis, 332
Form of disease in scrofulous kidney, 476
—— in tuberculous kidney, 475
Forms of malformed kidney, 55
——, Various, of cystic diseases of kidney, 500
Functional affection of bladder through renal disease, 443
Fusion of kidneys, or solitary kidney, 55, 65 82
——, Classification of forms in, 90
—— ——, completely united variety, 97
—— ——, horse-shoe kidney, 91
—— ——, intermediate variety, 95
——, Examples and specimens of, 84 *et seq.*
——, Extreme degrees of, 83
——, Singular forms of, 88
——, Supposed causes of, 87

Gastro-renal fistula, Case of, 261
General remarks on renal calculus, 451
Gonorrhœal rheumatism distinct from urinary fever, 421
Growth of tumour from hydro-nephrosis, Rate of, 303
Gun-shot wounds of kidney in American war, 161

Hæmaturia, 123
——, A symptom of penetrating wound of kidney, 155
——, Causes of, 123 *et seq.*
—— in renal calculus, 461
——, What may be denoted by, 123 *et seq.*
Hæmorrhage, Checking, in wounds of kidney, 175
—— from kidney caused by use of catheter, 285
—— excited by change of diet in subparietal injuries, 143
——, Diet in cases of, 143 *et seq.*
Hæmorrhage from kidney through catheterism, 435
——, Diagnosis of, 437
——, Pathology of, 439
——, Prognosis of, 438
——, Symptoms of, 435
——, Treatment of, 439
Hilum of Kidney, Structures at, 10
Horse-shoe kidney, 91
Hydatid cysts, 515
Hydro-nephrosis, 290
——, Affection of Kidneys by, 300
—— ——, Production of palpable abdominal tumour by, 301
Hydro-nephrotic abdominal tumour, Rate of growth of, 303
—— cyst, Fluid of, 307, 328
——, Diagnosis of, 314
——, Etiology of, 291
—— ——, acquired causes, 293
—— ——, congenital causes, 291
——, Pathology of, 304
——, Prognosis of, 317
——, Records of, in post-mortem examinations, 294
——, Symptoms of, 309
—— ——, Cases giving details of, 311 *et seq.*
——, Treatment of, 319
—— ——, Nephrotomy in, 322

Inability to extend thigh, symptom of perinephric abscess, 215
Importance of malformation of kidney, 50
Incision in suppuration, 224
—— to release pus, 243

Inflammation of distant parts a cause of perinephritis, 209
Inflammatory urinary fever, 285
Injuries of kidney, 116
——, Classification of varieties of, 116
—— communicating with open wound, 153
Intermediate variety of fused kidney, 95
Intermittent fever, acute and subacute, 413
—— in suppurative nephritis, 373
Interstitial nephritis, acute and subacute, 356
——, Causes of, 356
——, Diagnosis of, 360
——, Pathology of, 362
——, Prognosis of, 361
——, Symptoms of, 357
——, Treatment of, 363
Intestines, Renal fistulæ opening into, 265
Irregularities of renal arteries, 15

Kidney, Abscess of the, 272
——, Absence of one, or single, 63
——, Affection of, by hydro-nephrosis, 300
——, Anterior surface of, 1
——, Atrophy of one, 65, 76
——, Calculus in the, 451
——, Cancer in the, 496
——, Cicatricial, after suppurative nephritis, 395
——, Congestion of, in urinary fever, 404
——, Congestion or strangulation of, 41
——, Cystic diseases of, 500
——, Fibrous tissue of, 8
——, Floating, 45
——, Fusion of, or solitary, 82
——, Hæmorrhage from, through catheterism, 435
——, Horse-shoe, 91
——, Injuries of, 116
—— —— communicating with open wound, 153
—— ——, prolapse through external wound, 181
—— ——, Subparietal, 116
——, Malformations of, 51
——, Measurements of, 1
——, Misplacements of the, 16
——, Movable, 24
—— ——, produced by pregnancy, 28
Kidney, Penetrating wounds of, 153
——, Position of, 2
——, Posterior surface of, 2
—— ——, indications of boundaries of, on, 5
—— ——, space occupied by, on, 3
—— ——, structures covering, on, 6
——, Prolapse of, through external wounds, 181
——, Puncturing the, 522
——, Regional anatomy of, 1
——, Single, 63, 82
—— ——, Symptoms and diagnosis of, 100
——, Solid tumours of the, 495
——, Total absence of, 112
——, Tuberculous and scrofulous, 473
——, Tumours of the, 483
——, Unsymmetrical, 65, 70
——, Urinary fistulæ communicating with, 255
Kidneys, Affection of, by hydro-nephrosis, 300

Lameness an early symptom of perinephric abscess, 214
Lidell on gun-shot wound of kidney, 225
Liquor amnii, Analysis of, 333
Literature of irritation of bladder, etc., through renal diseases, 450
—— of perinephritis, 247
—— of suppurative nephritis, 397
—— of urinary fever, 434
Lobulation of kidney, 55
——, Notable cases of, 56 *et seq.*
Local irritation in urinary fever, 401
—— symptoms of perinephritis through pressure, 212
Localisation of seat of small abscess, 241
Loin, Renal fistulæ opening in, 258
Lumbar hernia consequent on incision for abscess, 245
—— incision in subparietal injuries, 148
—— nephrectomy, 42, 44, 530
—— —— in subparietal injuries, 148
Lung, Renal fistulæ opening into, 267

Malformations and congenital hydro-nephrosis, 331
—— of the kidney, 51
—— ——, Diagnosis of, 53

Malformations of the kidney, Forms of, 55
——, Importance of, clinically, 51
——, Remarkable cases of, 52, 56 *et seq.*
Measurement of kidney, 1
Mesentery or mesonephron, 45
Metamorphoses, Cystic, of kidney, in adults, 508
Misplacements of kidney, 16
Modes of performing operations on kidney, 521
Morbid anatomy in pyo-nephrosis, 341
—— **appearances in suppurative nephritis. 388**
Movable kidney, 24
——, Diagnosis of, 35
——, Distended gall bladder mistaken for, 37
——, Etiology of, 27
——, Extent of movement of, 26
——, Nephrectomy for, 41
——, Nephrorraphy for, 41
——, Ovarian tumours mistaken for, 36
——, Pathological anatomy of, 24
——, Symptoms of, 30
—— ——, physical signs, 33
—— ——, subjective symptoms, 31
——, Treatment of, 39
Movement of kidney, Extent of, 26
Myo-sarcoma, 499

Natural position of unsymmetrical kidney, 73
Nausea and vomiting in renal calculus, 460
—— —— **symptoms of wound in kidney, 157**
Nephrectomy for movable kidney, 41
—— **in renal calculus, 472**
Nephritis, Traumatic, 247
——, Suppurative, 366
Nephrorraphy, 530
—— **for movable kidney, 41**
Nephro-lithotomy, 525
—— **in renal calculus, 471**
—— **operation, 526**
Nephrotomy, 523, 530
—— **in hydro-nephrosis, 322**
—— **in renal calculus, 472**
Newman's electric lamp for illumination of orifices of ureters, 111

Œdema of foot and ankle a sign of perinephric abscess, 214

Open wounds, Injuries of kidney communicating with, 153
Operations on kidney, Modes of performing, 521
——, Nephrectomy, 522
——, Nephro-lithotomy, 521
——, Nephrorraphy, 521
——, Nephrotomy, 521
Organic affections of bladder through renal disease, 444
Ovarian tumours mistaken for movable kidney, 36

Palliative treatment of renal calculus, 468
Paranephric cysts, 514
Parasitic nephritis, 287, 288
Paroxysmal, lumbar, and sciatic pains in renal calculus, 459
Parturition, Interference of, by congenital hydro-nephrosis in, 330
Pathological anatomy of movable kidney, 24
—— **effects of renal calculus, 466**
Pathology of hæmorrhage from kidney through catheterism, 439
—— **of hydatid cysts, 515**
—— **of hydro-nephrosis, 304**
—— **of interstitial nephritis, 362**
—— **of penetrating wounds of kidney, 164**
—— **of perinephritis, 219**
—— **of renal abscess, 277**
—— **of subparietal injuries, 117** *et seq.*
—— **of suppurative nephritis, 387**
—— **of traumatic nephritis, 252**
—— **of urinary fever, 423**
Penetrating wounds of kidney, 153
—— **associated with wounds of stomach, etc., 158**
——, Cases of, ending in recovery, 167
——, Diagnosis of, 162
——, Pathology of, 164
——, Prognosis of, 167
——, Remarkable cases of, 159
—— ——, gun-shot wounds in American war, 161
—— ——, formation of abscesses, 158
—— ——, hæmaturia, 155
—— ——, nausea, vomiting, etc., 157
—— ——, retention of urine, 158
——, Symptoms of, 154
——, Treatment of, 172

Penetrating wounds of kidney, checking hæmorrhage, 175
—— ——, removal of clots of blood from bladder, 174
Perinephric abscess, 205
—— extravasations, traumatic and non-traumatic, 185
——, Causes and contents of, 185
—— ——, Air, 186
—— ——, Blood, 188
—— —— ——, Cases in illustration of, 193
—— —— ——, Diagnosis and symptoms of, 192
—— —— ——, Effusion of, from ruptured aneurism, 189
—— —— ——, Prognosis and treatment of, 190
—— ——, Fæcal, 204
—— ——, Purulent, 204
—— ——, Urine, 199
—— —— —— capsuled within cyst, 201
—— —— ——, Diffusion of, from pelvis of kidney, 200
—— —— ——, treatment, 208
Perinephritis and perinephric abscess, 205
——, Classification of, in groups, 205
——, Diagnosis of, 230
—— ——, Affections that may be mistaken for, etc., 230
—— —— ——, Blood extravasation, 239
—— —— ——, Disease of spinal column, 232
—— —— ——, Empyema, pneumonia, and abscess of lung, 234
—— —— ——, Fæcal accumulations, 234
—— —— ——, Inflammation and abscess of the psoas, 237
—— —— ——, Lumbago, 231
—— —— ——, Morbus coxæ, 235
—— —— ——, Nephralgia, 231
—— —— ——, Organic diseases of kidney, 231
—— —— ——, Perityphlitis and typhlitis, 233
—— —— ——, Splenic and hepatic tumours, 234
—— —— ——, Typhoid fever, 234
—— ——, localisation of seat of small abscess, 241
—— ——, whether primary or secondary, 239
——, Etiology of, 206
Perinephritis and perinephric abscess, causes consecutive on diseases of kidney, 207
—— —— consequent on inflammation of distant parts, 209
—— ——, primary causes independent of kidney, 206
——, Literature of, 247
——, Pathology of, 219
——, Cases of importance, 220 *et seq.*
——, Prognosis of, 228
——, Symptoms of, 210
—— ——, Local symptoms of, through pressure, 213
—— without suppuration, 217
——, Treatment of, 242
—— ——, early closing of consecutive abscess not desirable, 244
—— ——, incision to release pus, 243
—— ——, success of early incision and continued drainage, 246
Peritoneum, Renal fistulæ opening into, 289
Physical symptoms of movable kidney, 33
Polk's plan of catheterisation, 108
Position of kidney, 2
Post-mortem records of hydronephrosis, 294
Posterior surface of kidney, 2
Primary causes of perinephritis independent of kidney, 206
Prognosis of extravasation of blood, 199
—— of hæmorrhage of kidney through catheterism, 438
—— of hydatid cysts, 519
—— of hydro-nephrosis, 317
—— of interstitial nephritis, 361
—— of irritability of bladder through renal disease, 449
—— of penetrating wounds of kidney, 167
—— of perinephritis, etc., 228
—— of pyo-nephrosis, 352
—— of subparietal injuries, 133
—— of suppurative nephritis, 386
—— of traumatic nephritis, 253
—— of tuberculous kidney, 490
—— of urinary fever, 419
Prolapse of kidney through external wound, 181
—— may be partial or entire, 182
——, Various cases of, 183
Prophylactic treatment of renal calculus, 467
Prostatic enlargement through renal disease, 449

Psoas abscess, Case of, 238
Puncturing the kidney, 522
Purulent extravasation, 204
Pus in perinephric abscesses, 222
—— in urine in renal calculus, 461
Pyæmia different from suppurative nephritis, 379
—— distinct from urinary fever, 420
Pyelitis, 366
Pyelo-nephritis, 287, 288, 366
—— ——, how distinguished from acute Bright's disease, 378
Pyo-nephrosis, 336
——, Cases of, in Middlesex Hospital, 338
——, Diagnosis of, 348
——, Etiology of, 337
——, Morbid anatomy in, 341
——, Prognosis of, 352
——, Symptoms of, 345
——, Treatment of, 353

Rarity of cases of floating kidney, 47
Recovery from wounds of kidney, 167
Recurring paroxysmal fever, acute and subacute, 410
Regional anatomy of kidney, 1
Remarkable cases of malformation of the kidney, 52
—— in suppurative nephritis, 384
—— of tumours of kidney, 488
—— of wounds of kidney, 159
Ren sigmoideum of Broesike, 85
Renal abscess, or abscess of the kidney, 272
—— affections, Secondary, 282
—— consequent on disease in lower urinary organs, 282
—— consequent on surgical procedures on lower urinary organs, 283
—— consequent on urinary fever, 280
—— —— ——, congestive, 283, 285
—— —— ——, inflammatory, 285
—— —— ——, suppurative, 285
—— arteries, Irregularities of, 15
—— —— and vessels, 10
—— calculus, 451
——, Diagnosis of, 462
—— ——, Greatest difficulty in, 465
——, General remarks on, 451
——, Nephrectomy in, 472
——, Nephro-lithotomy in, 471
——, Nephrotomy in, 472
Renal abscess, Pathological effects of, 466
——, Symptoms of, 454
—— ——, hæmaturia, 461
—— ——, nausea, vomiting, and dyspepsia, 460
—— ——, paroxysmal, lumbar, and sciatic pains, 459
—— ——, pus in urine, etc., 461
—— ——, renal colic, 457
——, Treatment of, 467
—— ——, Palliative, 468
—— ——, Prophylactic, 467
—— ——, Surgical, 468
—— disease a cause of irritability of bladder, 441
—— —— a probable cause of prostatic enlargement, 449
——, Diagnosis of, 447
——, manner of affection, 444
——, nature of affection, 443
—— ——, Functional, 443
—— ——, Organic, 444
——, Prognosis of, 448
——, Symptoms excited, 445
——, Treatment of, 448
——, Literature of, 450
—— fistula a cause of perinephritis, 222
—— thrombosis, Theory of, 202
Retention of urine, symptoms of penetrating wound of kidney, 158
Rhabdo-myoma, 499
Rupture of single kidney, 138
—— of ureter, 140
Ruptured abdominal aneurism, 189
—— aneurism, Effusion of blood from, 189

Sarcoma, 495
Scrofulous and tuberculous kidney, 473
—— pyo-nephrotis and cystitis, 222
Second kidneys, Modes for ascertaining presence of:
—— by catheterisation of ureter, 107
—— by exploration of loin through rectum, 107
—— by exposing ureter of kidney, 107
—— by exploration through anterior abdominal incision, 108
—— by washing out bladder and examination of fresh urine, 108
—— by Polk's catheterisation, 108
—— by Tuchmann's "ureter forceps," 109

Secondary atrophy, Causes of, 79
—— **renal affections, 262**
Septicæmia, Acute, not suppurative nephritis, 379
—— **distinct from urinary fever, 421**
Sequelæ of renal disease, 441 *et seq.*
Silbermann's appliance for closing ureter, 111
Simple misplacements of kidney, 17
——, **acquired, 20**
——, **congenital, 17**
—— **or serous cysts, 501**
Singular forms of fusion of kidneys, 88
Single kidney, or absence of one, 63
——, **Anatomical and physiological guides in, 110**
—— **Diagnosis of, 100**
—— ——, **manipulation and palpation, 106**
——, **Modes of examination for, 107**
—— ——, **Various methods employed in examination, 107**
——, **Distinction between classes of, 64**
——, **Examination of cases of, 66**
——, **Symptoms of, 100**
—— ——, **size, 103**
——, **What is meant by, 63**
Situation of unsymmetrical kidney, 70
Size of single kidney, 103
—— **causes resemblance to pregnancy, 104**
—— **of unsymmetrical kidney, 71**
Solid tumours of the kidney, 495
——, **carcinoma and sarcoma, 495**
——, **Diagnosis of, 498**
——, **rhabdo-myoma or myo-sarcoma, 499**
——, **Symptoms of, 497**
——, **Treatment of, 499**
Solitary kidney, or fusion of kidneys, 55, 65, 82
Space occupied by kidney on anterior surface, 3
Strain or partial laceration of pelvis or ureter, 121
Strangulation or congestion of kidney, 41
Strapping in subparietal injuries, 142
Structures at hilum of kidney, 10
—— **covering kidney on posterior surface, 6**
Subacute interstitial nephritis, 356
Subparietal injuries of kidney, 116
——, **Causes of, 116**
——, **Diagnosis of, 135**
—— —— **in rupture of single kidney, 138**
—— ——, **rupture of the ureter, 140**
—— —— **Typical and instructive case in, 137**
——, **Pathology of, 117 *et seq.***
——, **Prognosis of, 132**
——, **strain or partial laceration of pelvis or ureter, 121**
——, **Symptoms of, 123 *et seq.***
—— ——, **Hæmaturia as, 123 *et seq.***
——, **distension of cavity of kidney with blood clot, 139**
——, **Treatment of, 141 *et seq.***
—— ——, **assuagement of pain by strapping, 142**
—— —— **by lumbar incision, 148**
—— —— **by lumbar nephrectomy, 148**
——, **Details of remarkable cases in, 148 *et seq.***
——, **Diet in, 142**
—— ——, **Hæmorrhage caused by, 143**
—— —— **in cases of hæmorrhage, 143 *et seq.***
—— —— **in cases of constipation, 147**
Subjective symptoms of movable kidney, 31
Supposed causes of fusion of kidneys, 87
Suprarenal capsule, Wounds of the, 180
Suppuration in perinephric tissue, 223
——, **Perinephritis without, 217**
Suppurative nephritis, pyelitis and pyelo-nephritis, 366
——, **Causes of, 367**
——, **Cicatricial kidney after, 395**
——, **Diagnosis of, 378**
——, **Difference of, from acute Bright's disease, 379**
—— ——, **from acute septicæmia, 372**
—— ——, **from less acute forms of septicæmia, 380**
—— ——, **from ague, 381**
—— ——, **from chronic cystitis, 380**
—— ——, **from pyæmia, 379**
—— ——, **from typhoid fever, 380**

Suppurative nephritis, pyelitis and pyelo-nephritis, from uræmia, 381
——, Intermittent fever in, 373
——, Literature of, 397
——, Remarkable cases in, 384
——, Pathology of, 387
—— ——, Morbid appearances in, 388
——, Prognosis of, 386
——, Symptoms of, 370
——, Treatment of, 395
—— urinary fever, 285
Surgical operations in urinary fever, 433
—— procedures, secondary renal affections through, 283
—— treatment of renal calculus, 468
Symptoms of extravasations of blood, 192
—— of hæmorrhage from kidney through catheterism, 435
—— of hydatid cysts, 517
—— of hydro-nephrosis, 309
—— of interstitial nephritis, 357
—— of irritability of bladder through renal disease, 445
—— of large cystic kidney, 510
—— of movable kidney, 30
—— of penetrating wounds of kidney, 153
—— of perinephritis, 210
—— of pyo-nephrosis, 345
—— of renal abscess, 278
—— of renal calculus, 454
—— of simple cysts, 505
—— of single kidney, 100
—— of solid tumours of kidney, 497
—— of subparietal injuries, 123 ***et seq.***
—— of suppurative nephritis, 370
—— of traumatic nephritis, 248
—— of tuberculous kidney, 477
Syncope sign of ruptured aneurism, 194

Transient paroxysmal fever, Acute, 407
Traumatic nephritis, 247
——, Pathology of, 252
——, Prognosis of, 253
——, Symptoms of, 248
——, Treatment of, 253
—— hydro-nephrosis, Case of supposed, 152
Treatment of hæmorrhage from kidney through catheterism, 439
Treatment of extravasation of blood, 199
—— —— of urine, 203
—— of floating kidney, 48
—— of hydatid cysts, 520
—— of hydro-nephrosis, 319
—— of interstitial nephritis, 363
—— of irritability of bladder through renal disease, 449
—— of large cystic kidney, 513
—— of movable kidney, 39
—— of paranephric cysts, 515
—— of penetrating wounds of kidney, 172
—— of perinephritis, etc., 242
—— of pyo-nephrosis, 353
—— of renal abscess, 280
—— of renal calculus, 467
—— of simple cysts, 507
—— of solid tumours of kidney, 499
—— of subparietal injuries, 141
—— of suppurative nephritis, 395
—— of traumatic nephritis, 253
—— of tuberculous kidney, 480
—— of urinary fever, 425
—— of urinary fistulæ, 259, 269
Truss for movable kidney, 40
Tuberculous and scrofulous kidney, 473
——, Diagnosis of, 478
——, Prognosis of, 480
——, Scrofulous form of disease, 476
——, Symptoms of, 477
——, Treatment of, 480
——, tuberculous form of disease, 475
Tuchmann's "ureter forceps," 109
Tumour in renal region, Case of, 226
Tumours of the kidney, 483
——, difference from other tumours, 492
—— —— from enlargement of liver, 492
—— —— from enlargement of lymphatic glands, 494
—— —— —— of spleen, 493
—— —— from fæcal abscess, perityphlitis, etc., 494
—— —— from flatulent or fæcal accumulations, 494
—— —— from ovarian tumours, 493
—— —— of suprarenal capsule, 493
——, Distinctive points about, 484
——, Exceptional features connected with, 488

Tumours of the kidney, Remarkable cases of, 488
——, Solid, of the kidney, 495
Typhoid fever different from suppurative nephritis, 380
Typical case of subparietal injury, 137

Unsymmetrical kidney, 55, 70
——, Abnormal position of, 75
——, Natural position of, in loin, 73
——, Number of ureters in, 71
——, Situation of, 70
——, Size of, 71
Uræmia different from suppurative nephritis, 381
—— distinct from urinary fever, 420
Ureter, 12
—— forceps of Tuchmann, 409
——, Relations of, with kidney, etc., 13
—— Variations of, in congenital atrophy, 81
——, Walls and muscles of, 14
——, Wounds of the, 176
Ureteral fistulæ, 270
Ureterotomy, 538
Uroters, Number of, in unsymmetrical kidney, 71
Urinary complications in perinephric abscess, 216
—— fever, 398
——, Diagnosis of, 420
—— ——, Distinction of, from ague, 421
—— —— ——, from gonorrhœal rheumatism, 421
—— —— ——, from pyæmia, 420
—— —— ——, from septicæmia, 421
—— —— ——, from uræmia, 420
——, Etiology of, 400
—— ——, in congestion of kidneys, 404
—— ——, in local irritation, 401
——, Literature of, 434
——, Pathology of, 423
——, Prognosis of, 419
Urinary complications in perinephric abscess, Treatment of, 425
——, Diet in, 430
——, Surgical operations in, 433
——, Varieties of, 283
——, Varieties of congestive forms of, 407
—— ——, Acute and subacute intermittent fever, 413
—— —— ——, Caseof, due to use of bougie, 415
—— ——, Acute and subacute recurring paroxysmal fever, 410
—— —— Acute transient paroxysmal fever, 407
Urinary fistulæ, 254
——, Case of, 176
——, Classification of, 254
—— communicating with kidney and pelvis of kidney, 255
—— opening in loin, 258
—— ——, Treatment of, 259
—— opening into different parts of intestines, 265
—— opening into the lung, 267
—— —— ——, Treatment of, 269
—— opening into the peritoneum, 269
—— opening into stomach, 260
—— —— ——, Remarkable case of, 261
Urinary pressure, Effects of increased, 287
Urine, Extravasation of, 199

Varieties of single kidney, Distinction between, 64

Wounds of kidney associated with wounds of stomach, etc., 158
—— of suprarenal capsule, 180
—— of ureter, 176
—— ——, case of Archbishop of Paris, 177
—— —— case of Auguste Labiche, 178
—— —— case of boy stabbed in back, 179

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